CROP EXPERIMENTS,

BOMBAY PRESIDENCY.

1887-88.

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No. 1963 of 1888.

From

The DIRECTOR, LAND RECORDS and AGRICULTURE,
Bombay;

To

The CHIEF SECRETARY to GOVERNMENT,
Revenue Department;

Poona, 10th November 1888.

Sir,

I have the honour to submit the usual analysis of the Crop Experiments during the year 1887-88. Some delay has occurred owing to my unfamiliarity with the task of reviewing them and my desire to master the subject as thoroughly as I could, while, as you are aware, my office has been under its full strength.

2. The experiments are 58 in number, or four fewer than last year, coming from the different Divisions as per margin. There was, however, a considerable falling off in the Southern Division. No experiments were received from the Kolába and Poona Districts and none from the under-mentioned officers who were through the greater part of the season in their districts:—

Division.	No. of Districts	Year.	No. of Experiments.	
			Received.	Reported.
Northern	6	1886-87 ...	21	17
		1887-88	22	21
Central	6	1886-87 ...	24	21
		1887-88 ...	27	25
Southern...	6	1886-87 ...	17	17
		1887-88 ...	9	9

Name.	Designation.	District.
Mr. E. MacCallum	Assistant Collector	Thána.
,, Jehangir Manekji	District Deputy Collector ...	Do.
,, G. M. Urquhart*	Assistant Collector	Panch Maháls.
,, K. R. Bomanji*	Do.	Kaira.
,, A. F. Maconochie	Do.	Ahmadnagar.
,, H. F. Silcock*	Do.	Poona.
,, W. P. Symonds*	Do.	Do.
,, Younghusband	Do.	Sátára.
,, E. L. Cappel	Do.	Sholápur.
,, Gurráv Rámchandra	District Deputy Collector ...	Do.
,, R. Knight	Assistant Collector	Belgaum.
,, Gurshidappa Virbasappa ...	District Deputy Collector ...	Do.
,, Náráyan Ganesh	Do.	Bijápur.
,, Shrinivás Báláji...	Do.	Do.
,, Sorábji Padamji...	Assistant Collector	Dhárwár.
,, H. W. J. Bagnell	Do.	Kolába.
,, Rangnáth Sadáshiv*	District Deputy Collector ...	Do.

* Collector's explanation received and noticed in the Analysis.

3. The following officers made only one instead of two ordinary experiments:—

Name.	Designation.	District.
Mr. M. P. Khareghát	Assistant Collector ..	Ahmadabad.
„ Pránlál Harkisandás ...	District Deputy Collector ...	Panch Maháls.
„ R. M. Kennedy	Assistant Collector ...	Thána.
„ E. C. Morrieson	Do. ...	Khándesh.
„ Stewart	Do. ...	Sátára.
„ Harvey	Do. ...	Bijápur.
„ H. Woodward	Do. ...	Belgaum.
„ Wiltshire	Do. ...	Kánara.
„ A. Lucas	Do. ...	Do.

If the orders of Government could have been literally complied with, we should have had no less than 100 experiments instead of 58, and with great deference I would suggest that a little more pressure should be exercised to obtain the full number.

4. In nearly all districts the special experiment is conspicuous by its absence. Three attempts were made at it, none of them successful and none of them by European officers. The reason of this is no doubt the objections raised to the present method of casting the results. I have ventured to add a memorandum (Appendix A) suggesting alterations which will, I hope, restore the special experiment to the position in the interest of experimenters and of Government to which its utility, when conducted with intelligence and appreciation, fully entitles it.

5. A good many attempts have been made to calculate the cost of cultivation with varying success. In this point also, I think uniformity and method will secure valuable results, and I append a note and form (Appendix B) with a few directions attached, which, I hope, will be of use, at any rate to the less experienced officers. The form might with advantage be generally adopted. The principles to be followed and objects sought in the calculation are explained in the note.

6. There is perhaps some disposition to under-rate the utility of investigation into the cost of cultivation on account of the difficulties in getting at the facts. These difficulties are without doubt formidable, but they are by no means insuperable. Even if in any particular case it be nearly impossible to get accurate information of every single process employed from the preparation of the land until the marketing of the crop, still by the comparison of the information accumulated by numerous enquirers a very intimate knowledge will in the course of time be obtained regarding the agricultural practices in different districts and soils, while the cost or value of the different acts of husbandry will be ascertained at any rate within limits. It is a great thing also that in the experimental farms we have an accurate record, for several well-known crops, of the actual labour, seed, manure, &c., bestowed on them, and their cost at known rates. This will serve as a standard whereby to measure estimates of cost of cultivation. By use of Mr. Ozanne's printed note on the subject (No. 185, dated 15th March 1884) and, it is hoped, of the directions (Appendix B) attached to this report, there should be little danger of experimenters omitting to enquire regarding most of the operations which ought to be taken into account.

7. Another very interesting point in connection with these experiments which have now been systematically recorded for five years is the correspondence of the yields with the formulæ, or figures, given for the average yield of the táluka. A note which I have appended on this subject (Appendix C) shows, I think, that so far as we have gone the formulæ are by no means so untrustworthy as might have been apprehended. The actual yields have varied a good deal from the formulæ and the formulæ estimates seem in particular instances to be somewhat, though not very much, too liberal. But the variations are quite accountable for on the obvious ground that the formulæ represent average yields taken over tracts in which the same crops are grown under widely varying conditions of soil, tillage, and even climate.

8. The suggestion of the Government of India brought forward at the Delhi Conference has been adopted and the ascertained yields have been ledgered by crops. This work has actually been brought up to date since the year 1883-84. Already the comparative results are most interesting and useful, and, as accumulated, should eventually furnish a very good notion of the production of the leading staples and crops in different tracts. For this purpose it would be better perhaps if a little more system were adopted in the selection of the crop and time and place of experiment. By the adoption of a few simple rules, it would be possible to secure a test in regular succession of the leading crops of the various tálukás, or perhaps even settlement groups of each district, and a systematic record gradually accumulated of their different productive capacities and agricultural practices.

9. As usual, standing orders have been a good deal neglected, sometimes to the fatal vitiation of results, thereby giving a good deal of useless trouble to the experimenter, or if not to him, then to the Director. I append a list of those most frequently neglected and commend it most earnestly to the attention of experimenters (*vide* Appendix D).

10. The best experiments have been submitted by the following officers :—

Northern Division : Mr. Gibb and Mr. Robertson ;

Central Division : Messrs. Fraser, Kánga, Vaidya and Vádekar ;

Southern Division : Messrs. Woodward, Gamble and Wiltshire.

I have the honour to be,

Sir,

Your most obedient Servant,

J. W. P. MUIR-MACKENZIE,

Acting Director, Land Records and Agriculture, Bombay.

ANALYSIS OF CROP EXPERIMENTS.

NORTHERN DIVISION.

Ahmadabad.

Three officers made crop experiments this year in the district:—

	Ordinary.
Mr. M. C. Gibb	3
„ M. P. Khareghát	1
„ Edalji Dosábhái	2
Total ...	6

Mr. M. C. Gibb, Assistant Collector.

Three experiments were undertaken by this officer, two in kharíf—bájri and rice (sutarsál), and one in rabi—wheat vájia, irrigated. In his bájri experiment (No. 1) the experimenter did not weigh the by-product. This operation should not be omitted where possible, as it is desirable to have a record of the yield in pounds for purposes of comparison. Mr. Gibb, I think, misapprehends the meaning of the last paragraph of Government Resolution No. 849 of 7th February 1888, Revenue Department. Relative values are not required as he seems to think. I request Mr. Gibb's attention to the remarks on columns 21 and 22 of the sample form, Director's Annual Report, 1883-84, pages 32-34, which are very clear regarding the manner in which this information should be supplied. Mr. Gibb has taken commendable pains to estimate the cost of cultivation, and all his experiments are intelligently and carefully reported. I hope Mr. Gibb will conduct a special experiment, as he seems thoroughly possessed of the judgment and interest required to secure a valuable result.

Experiment No. 1, Bájri.—Kharíf to be followed by rabi irrigated wheat. The cost of cultivation is estimated at Rs. 15 per acre, including half the dressing at the rate of 20 cart-loads per acre, and charging for the labour of the cultivator and his family. This is rather heavy for bájri, even allowing for the high price of labour near a cantonment. In spite of a moderate outturn also a net return of Rs. 9 per acre was realised. The experimenter should have noted whether the rate of manure in column 15 was per acre or for the whole field (*vide* remarks under Sátára, Crop Experiment Report, 1884-85, page 7).

Experiment No. 2, on Rice Sutarsál.—The soil was originally classed as dry-crop, but since its vicinity to the Háthmati Canal rice has been grown on it by means of irrigation from the canal. There are two defects in this experiment which mar the accuracy of otherwise interesting conclusions to be drawn from it. The plot tested was not measured. This spoils the calculation of the cost of cultivation. The principal product was not weighed accurately, which spoils the calculations as to yield for comparison. But the number of local sers being known it is easy to calculate the value of the yield, supposing the rate to be correct. The price of sutarsál rice was high and the crop very fair. At the unusual rate of Re. 1 per maund of 40 sers, the yield of 2,920 sers of grain per acre with straw was worth Rs. 76-5-1. The cost of cultivation, including assessment and water-rate, was a little over Rs. 25. This leaves the substantial margin of Rs. 50 and an incidence of assessment and water-rate taken together of only 8·70 per cent. on the value of net produce.

Experiment No. 3.—Vájia, irrigated soft red variety of wheat, sown after the reaping of bájri which was grown on the field as a kharíf crop. This grain, though locally considered of poor quality and never eaten by the well-to-do, is more grown than the Kátha variety owing to the great demand for it in Bombay for purposes of export to England, where it is said to be preferred on account of the large proportion of gluten in its composition, and it is probable that this variety will in a few seasons supersede Kátha and fetch a higher price. (Wheat Production and Trade of India, page 43.)

The only remark that need be made on this experiment is that the estimated yield is probably rather below the actual one, and Mr. Gibb was unable to take samples all over the field. The cost of cultivation, about Rs. 15 per acre, though moderate, tallies closely with that prevailing at Bhadgaon and leaves a handsome margin.

Mr. M. P. Khareghát, Assistant Collector,

Forwards only one (his first) ordinary experiment (No. 4) on irrigated wheat, Vájia. This experiment, however, emphatically shows the necessity of specifying carefully the market rates at which produce is valued. The crop is the same as that chosen by Mr. Gibb, but the rate charged is much higher, viz., only 26⅔ local sers per rupee. Mr. Gibb's was at 30½ sers per rupee. Hence, although the yield here is lower, the value is higher. Discrepancies of this sort will be avoided or duly explained if the amended directions are attended to. The cost of cultivation is estimated at Rs. 30 per acre, which is higher than probable, while the estimate is very rough.

Mr. Edalji Dosábhái, District Deputy Collector,

Submits two ordinary experiments (Nos. 5 and 6), one on unmanured and unirrigated Chásia Daudkháni or hard white variety of wheat, and the other on barley. The local estimate in annas should have been mentioned and the by-products are not accurately estimated, but the experiments are on the whole careful. The estimate of the cost of cultivation, to be of value, must be in greater detail than that recorded by Mr. Edalji.

Kaira.

Two officers, Mr. Carmichael and Mr. Motilál, conducted crop experiments in this district during the year under report. Mr. Bamanji's reasons for not conducting experiments do not appear very satisfactory. It is not impossible to conduct experiments at the same time as jamábandi. The Collector remarks that he has directed Mr. Bamanji to conduct experiments next season.

Mr. G. Carmichael, Assistant Collector,

Forwards two ordinary experiments (Nos. 7 and 8), one on barley and the other on wheat.

Experiment No. 7, Barley.—The land ordinarily takes a kharíf crop of bájri. This year it was fallow, and only the rabi crop of barley was taken. The incidence of the assessment this season—about 27 per cent.—would not be excessive in an ordinary year. The yield seems to have been carefully estimated. Part of this field was sown with seed imported from Benares. The variety which is known as Bodia is commonly grown in the Ahmadabad and Kaira Districts. It would be interesting to have more information regarding the practice of importing new seed.

Experiment No. 8, Wheat.—The extraordinarily small proportion of by to principal product is quite inexplicable and casts some doubt on the correctness of the calculations. In describing the character of the crop such points as specially long or short straw should invariably be noted. The particulars of cultivation and acts of husbandry have been specified, but without sufficient distinctness. The rates charged are obviously high, Rs. 1-8-0 for a man and pair of plough-bullocks for instance. Mr. Carmichael, it is hoped, will not give up attempts to estimate the cost of cultivation whether in ordinary or special experiments, and will make some use of the general directions now drawn up on the subject.

Mr. Motilál Chunilál, District Deputy Collector,

Sends in one ordinary experiment (No. 9) on spelt, Poptia, grown on alienated land. This experiment is of small value for estimating the incidence of the assessment. The holding ordinarily grows a kharíf and rabi crop, but the rabi crop alone was experimented on. This crop was grown in less than one-half of

the field. The rate of incidence on the area actually cultivated is scarcely worth knowing without information why the rest of the field was fallow. The yield per acre has been ascertained with accuracy and gives to the experiment its solo value. Standing orders are carelessly attended to.

Panch Maha'ls.

Messrs. Motilál Chunilál and Pránlál Harkisandás this year submit two ordinary experiments (Nos. 10 and 11) in the same field which are worked up into what is *called* a special experiment. But, as special experiments, these are worthless. Both Messrs. Motilál and Pránlál sent up experiments last year inaccurate in important details. The best that can be said for these experiments is that the yield of the crops experimented on is estimated with apparent accuracy. The neglect of standing orders and necessary precautions makes all other results nugatory. A special experiment comprises an entire holding, and the holding in question contained two fields with at least four crops. Only one field and two crops were experimented on. No attempt is made to estimate the yield of the other field, nor is any information afforded as to the manner in which the estimate of the yields of the untested crops was arrived at. The holding too was not well chosen and more than half was untilled owing to the cultivator's laziness. Holdings for special experiments should, as a rule, contain not more than the usual or necessary fallow. The yield of maize is unusually low and that of the wheat very high. If Mr. Pránlál had observed all necessary conditions in weighing the grain under experiment, the sample ser forwarded to this office was either not properly weighed (in Gujarát there is no measure ser) or the weighing balance was incorrect, since the sample weighed here 26 tolás instead of 40—the reported weight of the local ser. Taking, however, the figures in the return submitted by the experimenter as fairly correct, the results are: The field grows two crops, maize (kharif) and wheat (rabi). The acre yield therefore is—

	Principal Product.	By-Product.	Value.
	Lbs.	Lbs.	Rs. a. p.
Maize	275	225	5 15 2
Wheat	1,138	1,213	33 12 9
		Total ...	39 11 11

The total value of gross produce per acre during the year is Rs. 39-11-11, the assessment, Rs. 1-2-5, and percentage incidence, 2·90.

Broach.

Two officers, Messrs. Chunilál and Quin, forward four crop experiments this year, two on wheat, one on juvár and the fourth on láng, chickling vetch.

Mr. Chunilál Venilál, District Deputy Collector,

Has sent up two ordinary experiments (Nos. 12 and 13) conducted with care and accuracy and interesting from the manner in which the fields were selected. The soil of both bears an equal assessment and belongs to the same village. The crop in both instances is wheat. But in the one instance (experiment No. 12) the wheat follows láng, a pulse, in the other (experiment No. 13) cotton. The soil of the second, though bearing an assessment almost equal to the first, is by repute inferior to it. The cultivator of the first is an intelligent Patel, of the second a Bhil. The effect of rotation, soil and good cultivation shows itself in a handsome yield and low incidence of assessment in the first experiment, while the reverse is shown in the second. This is as it should be. The lands of Broach are highly assessed and of the first order of fertility; nothing but good farming will pay on such lands. I am glad to speak well of Mr. Chunilál's experiments this year as showing that he has taken pains to correct the defects which marked his former experiments.

Mr. Quin's experiments (Nos. 14 and 15) call for no special remark. The incidence of assessment again comes out high, but the crops experimented on (juvár and láng) are grown in cotton lands, and probably the yield of cotton is high enough to reduce the incidence over an average of years to a moderate proportion.

Surat.

Three officers submit crop experiments this year from the district :—

	Ordinary.
Mr. R. A. L. Moore	... 2
„ B. Robertson	... 2
„ Umedrám Ranchhoddás	... 2
Total	... 6

Mr. R. A. L. Moore, Assistant Collector.

Owing to inaccuracy in important points Mr. Moore's experiments had to be rejected last year, but this year the experiment on sugarcane is well conducted and reported.

Experiment No. 16, Sugarcane.—Vánsi, literally bamboo cane, is a small straw cane variety grown in Surat and Káthiáwár. Its hardness makes it popular where pig and jackal infest the locality. It matures with a very scanty supply of water and is even grown in tracts of heavy rainfall without irrigation or with a preliminary flooding only at planting time. When thus grown it is called "waterless" or "nipáni." It is hardy and produces *gul* of excellent colour and keeping qualities. Sugarcane is a specially important subject for experiment in Surat inasmuch as the area under cane in that district constitutes no less than 60 per cent. of the whole area under cane in Gujarát. The outturn in this experiment is very heavy and yielded a handsome return for very full and careful cultivation with liberal manure. It is well worth observing how much the dressing of castor-oil cake or *khol* had to do with the large outturn. An experiment is to be made with it on the cane in the Poona and Bhadgaon farms. The cost of cultivation is probably exaggerated. At Bhadgaon, with the same operations such as ploughings, &c., but without well-watering charges, it amounts to only Rs. 132 per acre including the canal water-rates. Calculated at the more reasonable rate of 5 annas per pair of bullocks and 3 annas per man, it amounts for the area under experiment to Rs. 150 per acre, which is very little more than at Bhadgaon.

In his experiment on wheat, the principal interest is the cost of cultivation which Mr. Moore brings out to Rs. 9-13-8 or nearly Rs. 10 per acre, which corresponds fairly with the rates on the Bhadgaon farm. Deducting the occupant's own labour the cost is reduced to only Rs. 8. Although Mr. Moore has adopted high rates, his method of calculation is good and sound. It approximates nearly to that recommended in the directions for calculation attached to this report. In estimating the by-product the straw is not taken into account, which as a cattle-food is by no means without value. Again the area selected for experiment is below the prescribed minimum. The experiment, therefore, though on the whole very well conducted and with considerable labour, is not of value in estimating the incidence of assessment or yield per acre, and I am reluctantly obliged to omit it from record.

Mr. B. Robertson, Assistant Collector,

Sends in two interesting experiments (Nos. 17 and 18) on Vál and gives, as I consider, excellent reasons for the selection of this crop which are alluded to in the body of the report. It is an important pulse eaten whole by the Káliparaj and accompanying cereals with the higher castes.

The two cases chosen by Mr. Robertson present features of special interest. In the one case (Experiment No. 17) the crop is grown as a make-shift in consequence of the failure of juvár and in dry-crop land unsuited to it. The cultivation is indifferent and the tiller of the soil a Dhodia. In the other (Experiment No. 18) the vál takes its proper place as the rabi crop following rice, in land of good quality. The cultivation is good and liberal and the proprietor from that clever farming class, the Anávla Bráhmans. Mr. Robertson has reported the experiment exceedingly well and intelligently. The yield is accurately calculated, full importance being given to the by-product—a point so often missed by experimenters. As might be expected, the Anávla gets nearly three times as much as the Dhodia. An attempt also has been made to calculate

the cost of labour expended on the land. But in reckoning the cost of cultivation Mr. Robertson should not omit such items as seed, manure and weeding. The labour bill amounts in the one case (Experiment No. 17) to Rs. 6 and in the other (Experiment No. 18) to Rs. 5-8-0 per acre. The Anávla's cultivation, though slightly cheaper, is considered far superior; no doubt the quality of the work was better. Mr. Robertson may consider whether in view of this fact he was right to estimate the wage value of the labour at the same rate in both cases. Mr. Robertson has also charged nothing for irrigation of the vál—an operation of considerable cost, and which of course added largely to the outturn. The incidence appears high owing to its being charged only on the second crop.

Mr. Umedrám Ranchhoddás, District Deputy Collector.

In Experiment No. 19 juvár was mixed with tur, and therefore it was necessary to give the proportionate area under each. The incidence in column 10 is calculated on juvár alone, and hence high. The tur was not ripe at the time of the experiment, but the experimenter should have made some better attempt to estimate the tur crop. I request Mr. Umedrám's attention to remarks on Mr. Heaton's experiments in Belgaum in 1884-85, Crop Experiment Report, pages 13-14, on the method of dealing with areas under mixed crops. Some explanation was required of the fact that the soil described by Mr. Umedrám as middling is more highly assessed than the other soil on which he experimented, and which is termed "aval káli" or best black. The yield on the latter was slightly superior, though the cultivation was less costly according to Mr. Umedrám's estimate. The rates charged are generally high, and they vary so inexplicably for different operations that the calculation of the cost of cultivation is not as valuable as it might be.

Tha'na.

It is a pity that only one officer sent an experiment from this district. Mr. Kennedy's experiment (No. 21) on cold weather rice seems to have been conducted with care; but the facts, as the Collector remarks, are stated a little vaguely. The weight of grain is startlingly high. Mr. Kennedy places his ser at 58 tolás, but the ser of grain sent to this office weighed only 45 tolás. The outturn even at this rate comes to nearly 2,000 lbs. per acre, which is very good for a 12-anna crop. The calculation also of the yield of straw is similarly vitiated by its having been weighed before being thoroughly dry.

CENTRAL DIVISION.

Kha'ndesh.

Five officers submit crop experiment reports from the district this year :—

	Ordinary
Mr. Morrieson	... 1
„ Walker	... 2
„ Kánga...	... 2
„ Shirhatti	... 2
„ Páuse	... 4
Total	... 11

Mr. E. C. Morrieson, Assistant Collector.

Experiment No. 22, Linseed.—Mr. Morrieson was unavoidably prevented from making a second experiment. This experiment is accurately conducted. Mr. Morrieson has apparently arrived at a very close estimate of the actual expenditure of the rayat on this field of 23 acres, probably his sole holding. Very little more trouble would have enabled him to present an interesting special experiment. Here at any rate it is made clear that after deducting all expenditure and assessment with local funds the rayat made Rs. 8-5-0 per acre. This would represent the amount he had from this field towards the keep of himself and family and the maintenance of his cattle, or something like Rs. 185 per annum. The only operations for which he used paid labour were reaping and watching the crop. All the rest was done by his own household and cattle.

Mr. T. Walker, Assistant Collector,

Forwards two ordinary experiments, one on bájri and the other on gram. I regret that I am unable to record either of these experiments, though they have both evidently cost Mr. Walker much time and trouble. I trust he will not be discouraged, but try again. The anomalous character of his results is due to the mistaken selection of his ground. The bájri experiment is taken on a piece of 24 gunthás out of a holding of 4 acres ; it is a mere by-crop, filling up the margin. The yield of gram, though reported a 12-anna crop, is actually less than the seed used to it. The soil is not apparently one ordinarily used for gram, and the field is part of an enormous holding. Mr. Walker should take simple cases for his early experiments. The cost of cultivation is very difficult to estimate, and Mr. Walker must make sure of the correctness of his information.

Mr. R. E. Kánga, District Deputy Collector,

Sends in two most carefully worked up ordinary experiments (Nos. 23 and 24) on monsoon or kharif jowári. They are very good specimens of their kind, showing a grasp of the subject and an interest in it, while the calculations are marked throughout with the strictest accuracy. I append a summary of Mr. Kánga's estimate at his rates and for the Erandol experiment at Bhadgaon farm rates for purposes of comparison. Considerable pains have been taken to show the cost of cultivation. Few experimenters have gone so thoroughly and accurately into the details :—

STATEMENT A.

Cost of cultivation of good land at Erandol as estimated by Mr. Kánga, and at the rates of wages at Bhadgaon. (Total area 2 acres 17 gunthás ; crop Jowári.)

Mr. Kánga's Rates—4 annas per man, 4 annas per bullock, and 1½ annas per woman, a day.
Bhadgaon Rates—3 annas per man, 5 annas per pair of bullocks, and 1½ annas per woman, a day.

Operation.	Men.	Women.	Days.	Cost. According to Experimenter's Estimate.	Cost. According to Bhadgaon Farm Rates.	Bullocks.	Days.	Cost. According to the Experimenter's Estimate.	Cost. According to Bhadgaon Farm Rates.	Total Cost for 2 acres 17 gunthás. According to the Experimenter's Estimate.	Total Cost for 2 acres 17 gunthás. According to Bhadgaon Farm Rates.	Cost per Acre. According to the Experimenter's Estimate	Cost per Acre. According to Bhadgaon Farm Rates.
Household Labour.				Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p	Rs. a. p.
First ploughing in December	4	..	4	4 0 0	3 0 0	8	4	8 0 0	5 0 0	12 0 0	8 0 0	4 15 2	3 4 9
Do. in March	4	..	3	3 0 0	2 4 0	8	3	6 0 0	3 12 0	9 0 0	6 0 0	3 11 5	2 7 7
Two harrowings in April and May	1	..	2	0 8 0	0 6 0	2	2	1 0 0	0 10 0	1 8 0	1 0 0	0 9 10	0 6 7
Sowing in July	2	..	1½	0 12 0	0 9 0	2	1½	0 12 0	0 7 6	1 8 0	1 0 6	0 9 11	0 6 9
Bullock-hoeing	2	..	5	2 8 0	1 14 0	2	5	2 8 0	1 9 0	5 0 0	3 7 0	2 1 0	1 6 8
Seed	..	..	..	..	..	..	..	..	..	0 5 3	0 5 3	0 2 2	0 2 2
Thrashing and winnowing	2	..	2	1 0 0	0 12 0	8	2	4 0 0	2 8 0	5 0 0	3 4 0	2 1 0	1 5 6
Miscellaneous	..	..	..	..	..	..	..	..	..	0 2 0	0 2 0	0 0 10	0 0 10
Carting the produce	1	..	½	0 4 10	0 3 8	2	½	0 9 8	0 6 0	0 14 6	0 9 8	0 6 0	0 4 0
Carting thorns and fencing	2	..	2	1 0 0	0 12 0	4	2	2 0 0	1 4 0	3 0 0	2 0 0	1 3 9	0 13 4
Total	..	..	..	..	..	..	..	..	..	38 9 9	25 12 5	15 13 1	10 10 0
Paid Labour.													
Hand-weeding in August (contract)	..	25	2	5 0 0	4 11 0	..	..	..	..	5 0 0	4 11 0	2 1 0	1 14 0
Do. in September (do.)	..	25	2	4 0 0	4 11 0	..	..	..	..	4 0 0	4 11 0	1 10 5	1 14 11
Cutting stalks (contract)	3	6	1	5 0 0	1 2 0	..	..	..	..	5 0 0	1 2 0	2 1 0	0 7 6
Tying bundles (do.)	..	..	..	..	..	..	..	..	..	1 0 3	1 0 3	0 6 7	0 6 7
Purchase of thorns for fencing	..	..	..	..	..	..	..	..	..	2 0 9	2 0 9	0 13 6	0 13 6
Watching	Payments in lump sums.					..	..	..	..	4 0 0	4 0 0	1 10 5	1 10 5
Do.										6 0 0	6 0 0	2 7 7	2 7 7
Customary dues						..	..	..	..	0 5 8	0 5 8	0 2 4	0 2 4
Total	..	..	..	..	..	..	..	..	..	27 6 8	23 14 8	11 4 10	9 13 10
GRAND TOTAL	..	..	..	..	..	..	..	..	..	65 12 5	49 11 1	27 1 11	20 7 10

STATEMENT B.

Cost of cultivation of good land at Kásoda as estimated by Mr. Kánga. (Area of the field under experiment No. 23, 4 acres 14 gunthás.)

Rates at Kásoda—3 annas per man, 5 annas per pair of bullocks and 1½ annas a woman, per day.

Operation.	Men.	Women.	Days.	Cost.	Bullocks.	Days.	Cost.	Total Cost for the Field.	Total Cost per Acre (average).	Remarks.
Household Labour.				Rs. a. p.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
First ploughing in December	1	..	15	2 13 0	2	15	4 11 0	7 8 0	1 11 7	
First harrowing in April	1	..	5	0 15 0	2	5	1 9 0	2 8 0	0 9 2	
Second do. in June	1	..	3	0 9 0	2	3	0 15 0	1 8 0	0 5 6	
Sowing in July	1	..	3	0 9 0	2	3	0 15 0	1 8 0	0 5 6	
Three bullock-hoeings	1	..	8	1 8 0	2	8	2 8 0	4 0 0	0 14 9	The 2-bullock plough with one man, paid at 6 annas a day, instead of 8 annas as shown here, and therefore actual cost 11 annas per acre.
Thrashing and winnowing	2	..	2	0 12 0	6	2	1 14 0	2 10 0	0 9 8	The bullocks were obtained on loan, therefore the actual cost to the owner was 2 annas 9 pies the acre instead of 9 annas and 8 pies as shown here
Making thrashing floor	1	..	2	0 6 0	..	..	..	0 6 0	0 1 4	
Carting the produce home	2/5	..	1	0 6 6	1/5	¼	0 10 11	1 1 5	0 4 0	
Seed	..	..	..	..	..	..	..	0 5 6	0 1 3	
Total Cost—Household labour	..	..	..	..	..	..	..	21 6 11	4 14 9	
Paid Labour.										
Cutting crop—by contract wages	2	3	1	..	..	..	..	2 14 8	0 10 9	
Tying bundles do.	..	Payments in lump		..	..	..	..	0 12 8	0 2 11	
Hand-weeding do.	..	10	3	..	..	..	..	3 0 0	0 11 0	
Customary dues	..	..	..	..	..	..	..	4 0 0	0 14 8	
Total Cost—Paid labour	..	..	..	..	..	..	..	10 11 4	2 7 4	
GRAND TOTAL	..	..	..	..	..	..	..	32 2 3	7 6 1	

Cost per Acre.	Home labour.	Paid labour.	Total.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
According to uniform rates (Bhadgaon)	4 14 9	2 7 4	7 6 1
Actual cost to the owner	4 4 1	2 7 4	6 11 5

Gross Produce.	Net Produce excluding Paid Labour.	Net Produce excluding Total Cost.
Rs. a. p.	Rs. a. p.	Rs. a. p
26 15 4	24 8 0	19 9 3
....	....	20 3 11

Experiment No. 23 at Erandol.—The cultivator has 2 ploughs and 8 bullocks and is assisted by 3 adult members of his family. The field, 2 acres 39 gunthás in area, grows kharif and rabi crops and commands irrigation from a well which is occasionally used if required. It was manured at 34 cart-loads the acre the previous year for a crop of irrigated wheat. The bulk of the necessary operations was performed by the cultivator and his family—two men and two women. The cash charges for extra labour employed per acre is Rs. 11-4-10, and those for labour performed by the family, supposing prevalent rates of wages, is reckoned at Rs. 15-13-1 per acre, that is, Rs. 27-1-11 in all. But this estimate is, I think, incorrect. The charge of Rs. 1-8-0 per plough of four bullocks is too high; one rupee I should consider ample, even allowing for the high wages near Erandol. Mr. Kánga rightly charges about 8 annas for a plough with two bullocks at Kásoda, viz., 3 annas per man and 5 annas per pair of bullocks (*vide* Statement B. above).

In Experiment No. 24 at Kásoda, the land is of moderate quality and cultivation indifferent. Cultivator has one plough and 2 bullocks and has been doing the whole work himself assisted by 2 women of his household. He borrowed bullocks, &c., when necessary, and himself watches the crops. Labour is cheaper at Kásoda than at Erandol, and the cultivation is indifferent. The total charge of cultivation is Rs. 6-11-5, including household labour, and Rs. 2-7-4 excluding it. The results of the two experiments are compared in the following table :—

STATEMENT C.

Comparative Table of Results per Acre on Mr. Kánga's figures (Statements A. and B.).

Experiment.	Value of Gross Produce.	Cost of Cultivation.			Net produce.				Percentage Incidence of assessment on value of Produce.			Remarks.
		Charge for paid labour only.	Gross charge for labour.	Assessment.	Deducting charge for paid labour.	Deducting gross charge for labour.	Deducting columns 3 and 5.	Deducting columns 4 and 5.	On value of gross produce.	On value of net produce in column 6.	On value of net produce in column 7.	
1	2	3	4	5	6	7	8	9	10	11	12	13
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.				
Erandol	41 3 4	11 4 10	27 1 11	2 1 6	29 14 6	14 1 5	27 13 0	11 15 11	5·08	7·00	14·87	Charge for gross labour includes both charges for the household and paid labour.
Kásoda	26 15 4	2 7 4	6 11 5	1 2 4	24 8 0	20 3 11	23 5 8	19 1 7	4·25	4·67	5·66	

It appears that incidence of assessment on the gross produce is very moderate at both places. Mr. Kánga makes out the incidence on the net produce to be much higher at Erandol. But omitting the charge for household labour it will be found upon Mr. Kánga's figures that the incidence at Erandol is only 7 per cent. or scarcely at all higher than in Kásoda, while the value of the net produce is much higher. The charge for external labour includes a heavy one (Rs. 4-2-0 per acre) for watching, which the cultivator to all appearance might have easily undertaken himself. As long as higher cultivation and better land yields a better return and incidence is moderate, there is nothing to be alarmed at in the incidence being higher than on poorer land even though the latter be less well farmed.

Mr. H. R. Shirhatti, District Deputy Collector,

Contributes two ordinary experiments (Nos. 25 and 26) made in the Amalner Tálúka, one on wheat and the other on gram. Local name of the variety of wheat is doubtful. The experimenter bases his calculations in column 19 of the return at 134 tolás = 1 local measure ser of wheat, and 136½ tolás = 1 ser of gram, while the samples received in this office weighed 143 tolás for one ser of wheat and 139 tolás of gram. Mr. Shirhatti should have noted the average weight of the sample ser and dryage. It becomes doubtful whether the grain was

weighed well dried and with an accurate balance. Both the tests show very high yields:—

	Local Estimate in annas.	Formulæ Yield.	Actual Yield.
Experiment No. 25, Wheat ...	12	800	1,002
Experiment No. 26, Gram... ...	12	560	1,272

The incidence also is remarkably moderate. The cost of cultivation has been well summarized and in the wheat field comes to Rs. 12-9-0 per acre and in the gram field to Rs. 4-4-2, which rates are reasonable and probable. They include household labour. It would have been interesting to know the cost exclusive of this item.

Mr. G. D. Pánse, Assistant Collector.

Mr. Pánse appears to have taken considerable pains this year, but it is again necessary to draw his attention to the necessity of minute accuracy. Mr. Pánse has given figures for cost of cultivation which add up well and look reasonable enough. But they are all in round numbers and thus look like mere estimates rather than the results of careful and minute inquiry. The men, bullocks, rate and days employed in each operation should be mentioned. It is believed the other results are trustworthy, and I this year record all the experiments (Nos. 27, 28, 29 and 30). But Mr. Pánse should recollect that the record of an experiment should be terse and businesslike and leave no room for the suspicion that any figures have not been carefully verified by the experimenter himself. In a future season Mr. Pánse will receive much assistance by consulting the record of this season's experiments by Mr. Kánga.

Na'sik.

Government Resolution No. 4755 of 3rd July 1886, paragraph 1, and No. 6997 of 1st October 1886, Revenue Department, require for special reasons that each Assistant and District Deputy Collector in Násik should make at least six ordinary experiments. The experiments received from the district are:—

	Ordinary.
Mr. J. Davidson	2
„ Fraser	2
„ Shridhar Gundo	3
Total ...	7

Mr. J. Davidson, Assistant Collector.

Mr. J. Davidson submits two accurately recorded experiments (Nos. 31 and 32) the results of which are specially interesting in connection with the formulæ and are alluded to in the general remarks on that subject. I do not concur with Mr. Davidson in his remarks as to the inutility of estimating the cost of cultivation on fields forming only portions of holdings. I am sorry to observe that Mr. Davidson believes the rayats got little benefit from the rise in the price of bájri last season, owing to the necessity of repaying to their sávkárs in kind. It is, I believe, possible that this evil is diminishing, at any rate in parts close to rail communication. In two or three instances last cold weather the rayats of Kopargaon Táluka in Ahmadnagar volunteered me the information that their chief benefit from the railway was that agents came from the big towns and enabled them to get a ready sale and the market value for their grain, and thus to avoid borrowing the cash they wanted or repaying in kind at the rates fixed by the money-lender.

Mr. S. M. Fraser, Assistant Collector.

Last year this officer submitted two carefully conducted experiments on wheat and his this year's experiments on irrigated rice and gram are equally good.

Experiment No. 33, irrigated rice Kamod following sugarcane. The cultivation is well described and I propose to print the experimenter's reports and remarks in full in Appendix E. The report is a model for accuracy and careful attention to necessary precautions, while the remarks are very useful and interesting to a careful student of local practices in agriculture. The case

selected is an excellent specimen of high and vigorous farming. The rice crop was green-manured with tág ploughed in, the resulting yield of rice was remarkably good and the land was to give another crop of irrigated wheat, in the rabi season. Mr. Fraser pointed to the incidence as somewhat high on the rice crop, but when it is remembered that out of the Rs. 11 assessment, Rs. 9 was for special water-rate, I do not think the charge can be considered high even for one crop. Taking credit for a fair second crop of wheat the incidence was probably not more than ten per cent., which is most moderate. The gram experiment (No. 34) is less interesting but no less accurate than the rice experiment. Mr. Fraser is puzzled at the discrepancy of the yield as compared with the formulæ. Reduced to bushels the discrepancy is after all not very formidable and easily accountable for by actual variations in soil and cultivation.

Mr. Shridhar Gundo, District Deputy Collector,

Submits three ordinary experiments (Nos. 35, 36 and 37), one on bájri and one on nágli, and the third on wheat.

Bájri was sown in rows with tur and kulith at intervals, viz., one row of tur and kulith to two rows of bájri. In every 6 guntha area tested by Mr. Shridhar Gundo, 4 were under bájri. For ascertaining the incidence, therefore, the test was equivalent to one taken over 4 gunthás of bájri on the area of the field sown with bájri. The gross produce came to 200 lbs. grain and 840 lbs. straw per acre.

	Rs.	a.	p.
Total value of produce	5	15	0
Assessment	0	10	8

which gives an incidence of 11·23 per cent. The method of testing row-crops has been carefully explained (*vide* Mr. Heaton's experiments in 1884; Crop Experiment Report, pages 13-15), and it is hoped Mr. Shridhar Gundo will attend more minutely to the instructions in future. I record the experiment (No. 35) with the amended figures. The other two experiments are accurate, but call for no further remark. Mr. Shridhar Gundo's estimate of the cost of cultivation is well framed. I insert that for bájri, adding the Bhadgaon rates for comparison :—

Cost of Cultivation of 13 acres 20 gunthás of Bájri land in Dindori at the rates of 2 annas per Man and 3 annas per Bullock, compared with the cost at the Bhadgaon Farm rates, 3 annas per Man and 5 annas per pair of Bullocks.

Operation.	Men.	Women.	Days.	Cost. At Experimenter's estimate.	Cost. At the Bhadgaon Farm rates.	Bullocks.	Days.	Cost. At Experimenter's estimate.	Cost. At the Bhadgaon Farm rates.	Total Cost. At Experimenter's estimate.	Total Cost. At the Bhadgaon Farm rates.	Total cost per Acre. At Experimenter's estimate.	Total cost per Acre. At the Bhadgaon Farm rates.
Household Labour.				Rs. a. p.	Rs. p.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Ploughing	1	..	6	0 12 0	1 2 0	4	6	4 8 0	3 12 0	5 4 0	4 14 0	0 6 3	0 5 9
First harrowing	1	..	3	0 6 0	0 9 0	2	3	1 2 0	0 15 0	1 8 0	1 8 0	0 1 9	0 1 9
Second do. after the first showers	1	..	10	1 4 0	1 14 0	4	10	7 8 0	6 4 0	8 12 0	8 2 0	0 10 4	0 9 7
Sowing	1	..	4	0 8 0	0 12 0	2	4	1 8 0	1 4 0	2 0 0	2 0 0	0 2 4	0 2 4
Seed covering	1	..	4	0 8 0	0 12 0	2	4	1 8 0	1 4 0	2 0 0	2 0 0	0 2 4	0 2 4
Bullock-hoeing	2	..	4	1 0 0	1 8 0	2	4	1 8 0	1 4 0	2 8 0	2 12 0	0 3 0	0 3 4
Conveying crop from field to threshing floor	1	..	1	0 4 0	0 6 0	6	1	1 2 0	0 15 0	1 6 0	1 5 0	0 1 8	0 1 7
Total	..	..	..	..	..	–	..	..	..	23 0 0	22 9 0	1 11 8	1 10 8
Paid Labour.													
Seed	..	..	..	..	..	..	..	..	..	2 8 0	2 8 0	0 2 11	0 2 11
Reaping	8	..	6	6 0 0	9 0 0	..	..	..	..	6 0 0	9 0 0	0 7 2	0 10 8
Threshing and winnowing	3	..	4	1 8 0	2 4 0	8	4	6 0 0	5 0 0	7 8 0	7 4 0	0 8 10	0 8 7
Watching	..	..	..	..	..	..	..	..	..	1 8 0	1 8 0	0 1 9	0 1 9
Customary dues	..	..	..	..	..	..	..	..	..	4 0 0	4 0 0	0 4 10	0 4 10
Total	..	..	..	..	..	..	..	..	..	21 8 0	24 4 0	1 9 6	1 12 9
Grand Total	..	..	..	..	..	..	..	..	..	44 14 0	46 13 0	3 5 2	3 7 5

Value of Gross Produce.	Cost. At experimenter's estimate.	Cost. At the Bhadgaon Farm rates.	Net Produce. Deducting cost at experimenter's estimate.	Net Produce. Deducting cost at Bhadgaon rates.
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
5 15 0	3 5 2	3 7 5	1 9 10	2 7 7

Poona.

None of the officers of this district made any crop experiment this year .. owing to want of leisure. The Collector writes :—

" Mr. Symonds has had such time as he could spare from his ordinary duties taken up with preparing his report on fixing standard weights and measures, and Mr. Silcock is the Forest Settlement Officer as well as Assistant Collector. In addition to this he has been engaged on a special enquiry."

Ahmadnagar.

One officer only, Mr. V. B. Vádekar, District Deputy Collector, makes crop experiments this year in the district. The reason for so few experiments being made is not explained by the Collector, but it obviously consists in the frequent and, for experimental purposes, inopportune changes of personnel in the district during the year.

The tests are on jowári and irrigated wheat (Bakshi) and both are well conducted and reported. The land selected for the jowári experimented on was *Mál Rán*. Jowári on such land is often only a catch crop sown as a desperate resource on failure of kharif. The yield is no more than could be expected and such yields are of course not taken into account in calculating general average for a táluka. The other experiment calls for no special remarks. The data for calculating out the cost of cultivation are well given, and I have summarized them in tabular form. The rates assumed by Mr. Vádekar for preliminary field operations are probably too low, but are at any rate nearer the mark than the high lump sums, so frequently put down without reason assigned in estimates of this kind :—

Cost of Cultivation of a filed of 4 acres 15 gunthás in Shrigonda—Wheat.

Experimenter's Rates—2 annas per man, 1 anna per bullock and 2 annas per woman, a day.
Bhadgaon Rates—3 annas per man, 5 annas per pair of bullocks and 1½ annas per woman, a day.

Operation.	Men.	Women.	Days.	Cost. Experimenter's Estimate.	Cost. At Bhadgaon Farm Rates.	Bullocks.	Days.	Cost. Experimenter's Estimate.	Cost. At Bhadgaon Farm Rates.	Cost—4 Acres 15 gunthás. Experimenter's Estimate.	Cost—4 Acres 15 gunthás. At Bhadgaon Farm Rates.	Cost per Acre. Experimenter's Estimate.	Cost per Acre. At Bhadgaon Farm Rates.
Household Labour.				Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Ploughing	2	..	15	3 12 0	5 10 0	10	15	9 6 0	23 7 0	13 2 0	29 1 0	..	..
Harrowing	2	..	25	0 4 0	0 6 0	4	25	6 4 0	15 10 0	12 8 0	25 0 0	..	..
Reaping	2	..	9	2 4 0	3 6 0	..	..	..	..	2 4 0	3 6 0	..	..
Threshing	2	..	4	1 0 0	1 8 0	12	4	3 0 0	7 8 0	4 0 0	9 0 0	..	..
Winnowing	2	..	4	1 0 0	1 8 0	..	..	..	..	1 0 0	1 8 0	..	..
Total	..	..	..	..	..	..	..	..	..	32 14 0	67 15 0	7 8 3	15 8 5
Paid Labour.													
Weeding	..	8	20	20 0 0	15 0 0	..	..	..	..	20 0 0	15 0 0	..	..
Reaping (4 annas per man)	3	..	9	6 12 0	5 1 0	..	..	..	..	6 12 0	5 1 0	..	..
Winnowing (do. do.)	1	..	4	1 0 0	0 12 0	..	..	..	..	1 0 0	0 12 0	..	..
Separating wheat from ears (4 annas per man)	3	..	4	3 0 0	2 4 0	12	4	3 0 0	7 8 0	6 0 0	9 12 0	..	..
Customary dues one-eighth of the gross produce	..	..	..	..	..	..	..	..	..	4 0 0	4 0 0	..	..
Total	..	..	..	..	..	..	..	..	..	37 12 0	34 9 0	8 10 1	7 14 6
Grand Total	..	..	..	..	..	..	..	..	..	70 10 0	102 8 0	16 2 4	23 0 10

	Rs. a. p.	Rs. a. p.
Thus the total cost is Rs. 70-10-0 for 4 acres 15 gunthás.		
Therefore the cost per acre is Rs. 16-2-4 and the value of gross produce per acre	32 1 11	32 1 11
Deduct cost per acre	16 2 4	23 0 10
Net Produce	15 14 7	8 11 1
Hence the incidence of assessment (Re. 0-6-5) on value of net produce	2·52	4·61

Shola'pur.

Only one officer, Mr. N. B. Divatia, Assistant Collector, submits two ordinary crop experiments from the district this year. These are both careful and accurate, though Mr. Divatia's first attempt. They well illustrate the great advantage derived by the rayat from the exemption of his improvements from taxation under the revenue system of this Presidency. No further comment on them is necessary.

Sa'ta'ra.

Three officers submitted crop experiments this year from the district:—

Experimenter.	Ordinary.		Special.
Mr. R. B. Stewart	1		0
„ R. K. Vaidya	1		0
„ L. G. Deshmukh	3	or	1
Total ...	5		

In all five, but three ordinary experiments of Mr. Deshmukh are embodied in one special experiment.

Mr. Stewart's experiment (his first attempt) is creditably conducted. The estimate of the cost of cultivation is hardly precise enough, and the crop perhaps being unusual in the soil described not quite the best to select. In one or two small points the standing orders should be more narrowly adhered to.

Mr. R. K. Vaidya, District Deputy Collector,

Sends in one very carefully conducted ordinary experiment on Dukri (a somewhat coarse variety of jowári) mixed with tur in the proportion of 7 to 1. Tur was not ready at the time of the experiment and therefore the incidence in column 10 is calculated on jowári alone. The field selected for experiment was Devasthán inám, the entire area of which is 12 acres 29 gunthás assessed at Rs. 25. The Inámdár leased it for Rs. 15 rent each to two men, each of whom cultivates 6 acres 14 gunthás 8 annas, assessed at Rs. 12-8-0. The Inámdár thus takes about Rs. 20 per cent. above the assessment.

The cost of cultivation has been calculated with great accuracy and I have given it in tabular form in Appendix F. It will be seen that the field of six acres took up the time of one man for 42 days and cost in external labour the value of about Rs. 4 per acre. This is not high, but it will be seen that no extravagant profit results to the cultivator. Now supposing the whole number 6 acres 14½ gunthás under Dukri alone, the cultivator's profit would be—Value of the yield of the whole area 6 acres 14½ gunthás at Rs. 11-7-10 per acre = Rs. 73-1-7.

Out of this sum the cultivator has to pay the rent Rs. 15 and the cultivation charges amounting to Rs. 25-13-1. Therefore the net profit is Rs. 32-4-6 or about Rs. 5 per acre.

Mr. L. G. Deshmukh, Assistant Collector.

Mr. Deshmukh has furnished a special experiment compounded of three ordinary ones (Experiments Nos. 44, 45, 46). The holding consisted of 13 acres 34 gunthás, of which 10 gunthás were classed as pot kharáb. It belonged to a family of nine—four adult men, three women, and two boys—one nearly full grown. The crops were as follows:—

	Acres	g.
Dukri jowári and tur in rows 3 : 1	7	0
Rála	2	0
Bájri	2	0
Uncultivated	2	24
Total ...	13	24

The value of the outturn was:—

The outturn of tur was estimated by experiment on a similar crop elsewhere.

	A.	g.		Rs.	a.	p.		Rs.	a.	p.
Dukri ...	5	10	at	16	0	0	per acre =	84	0	0
*Tur ...	1	30	at	8	0	0	„ =	14	0	0
Rála ...	2	0	at	2	10	6	„ =	5	5	0
Bájri ...	2	0	failure	...	...	...	...	...		
							Total ...	103	5	0

The cost of cultivation is thus estimated. All the operations were conducted by the members of the family. The labour for weeding, watching, winnowing, &c., and other operations done by hand is not specified because not charged for. The family, however, owned no bullocks and these apparently had to be

paid for. The actual rate paid is not given, but is taken at 6 annas per pair per diem. The cost of cultivating the bájri is not estimated. The following are items of cost :—

Operation.	Pairs of bullocks at 6 annas per pair.	Days.	Cost. Rs. a. p.
(1) *Dukri and tur* mixed together—Area 7 acres.			
Ploughing	4	14	21 0 0
Harrowing	2	7	5 4 0
Cross-harrowing...	1	4	1 8 0
Manure, 10 carts at Re. 1 each cart	...	...	10 0 0
Conveying to fields the same, at 8 annas a cart ...	...	...	5 0 0
Sowing	1	5	1 14 0
Bullock-hoeing	1	5	1 14 0
Harvesting	1	2	0 12 0
Total ...	...	...	47 4 0
(2) *Rála*—Area 2 acres.			
Ploughing	2	4	3 0 0
Harrowing	1	2	0 12 0
Sowing	1	1	0 6 0
Seed 8 lbs., at 55 lbs. the rupee	...	...	0 2 0
Total ...	...	...	4 4 0
(3) *Bájri*—Area 2 acres.			
Say, same as Rála	...	...	4 4 0
Customary dues said to be one-seventeenth of the gross produce...	...	...	6 1 0
Local Funds	...	...	0 12 0
Total Cost ...	...	...	62 9 0

or Rs. 4-9-7 per acre.

Mr. Deshmukh also charges Rs. 4-6-0 for replacement of stock. But replacement of dead-stock is included in payment of customary dues; replacement of live-stock is not charged for since the family has none.

Thus the net outturn is only Rs. 40-12-0 or Rs. 3 per acre on the holding. It is obvious that this cannot maintain the above family for a year.

Mr. Deshmukh mentions that two adults live entirely by labour elsewhere—actually getting Rs. 24 and their food. This may be taken as the standard of subsistence for the adult man in this family. The amount, therefore, required for a year's subsistence for the remaining seven members would be—

2 men at Rs. 24	Rs. 48
3 women at say Rs. 18	„ 54
2 boys at Rs. 12	„ 24
Total ...	Rs. 126

The holding, therefore, cannot support them for more than one-third of the year. Mr. Deshmukh, however, comes to the conclusion that it actually supported five members—the women and boys for the whole year, and two men who stay at home for six months. During the other six months the men earned between them, according to Mr. Deshmukh's *estimate*, about Rs. 35. A marriage took place costing Rs. 75, for the expenses of which the family borrowed Rs. 60 and contributed out of current income Rs. 15!

It certainly is difficult to see how this was possible from the figures. The net yield of the holding is Rs. 40, supplementary earnings are Rs. 35, total

Rs. 75; out of this a sum of Rs. 15 is given to a marriage and Rs. 60 only remain for the support of seven people or less than Rs. 9 per head per annum. The probability is that the charge for cultivation is over-estimated and the earnings apart from cultivation are under-estimated. The bullocks were probably lent in exchange for labour of the adults, while the manure also probably cost much less.

Halving the cost of cultivation and allowing that the adults when at liberty earned 3 annas instead of 1½, we make up the sum required thus:—

	Rs.	a.	p.
Yield from field	72	0	0
Earnings	70	0	0
Total ...	142	0	0

which would probably support the seven members who live at home, and perhaps yield a small surplus.

I am aware that my figures are speculative, but so are some of Mr. Deshmukh's, and I am only anxious to impress upon experimenters the necessity of testing the probability of their results, and if they are apparently improbable of endeavouring to account for the apparent anomalies.

Lastly, I would remark that an experiment of this kind shows how necessary it is to ascertain the number of *days* occupied in the different acts of husbandry in order that a correct estimate may be made of the amount of time devoted by the holder to cultivation. In the present instance quite two months were devoted to operations with the bullocks. The last crop was reaped in December. It may be that all seven members of the family were fully occupied in weeding, watching, &c., up to December 5th, but it is difficult to see why they should be. Assuming they were, the two adults could work five months and a half up to May 20th. If they left the watching to their women and boys they might have had at least a couple of months more. I mention these points solely to indicate how minute must be the inquiry made by experimenters when conducting a special experiment, in order to make it of real value.

SOUTHERN DIVISION.

Belgaum.

Mr. H. Woodward, Assistant Collector.

Mr. Woodward furnishes an excellently conducted experiment on sugarcane. The cost of cultivation has been carefully estimated and I have exhibited the result in tabular form attached to the rest of Mr. Woodward's account which I print in full. It will be seen that if Mr. Woodward's information was correct the actual time spent in cultivation was only '78 days. This is no doubt on account of the abundant rainfall by which the land was flooded and the time and expense of irrigation by the basket heaving was saved. This would ordinarily require 14 days' more work. The amount of bullock work, it will be remarked, is very small. The cost of cultivation on account of this item saved comes to Rs. 104 per acre. Mr. Woodward does not mention how much of the manual labour was furnished by the cultivator himself or his family, but the figures indicate that he could keep himself and his cattle during the period of cultivation and have a surplus of Rs. 42 per acre or more than nine times the assessment. This is quite all he has a right to expect. It may be said indeed that the land pays him well.

Dha'rwa'r.

Two officers made crop experiments this year in the district, Mr. Gamble and Mr. Purandhare.

Mr. R. A. Gamble, Assistant Collector,

Forwards two carefully worked up ordinary experiments, one on jowári and the other on gram.

Experiment No. 48, Jowári.—Late jowári is not grown to a very great extent in the Ránebennur Táluka and is generally, as in the present instance, grown when the rain falls unseasonably for early jowári. The crop under experiment was a good one and rather above those in the neighbouring fields, this being due to a great extent to the digging and turning of the soil, locally called *natt kadiona*—an expensive operation repeated by good cultivators every 8th to 10th year with the object of destroying the karki weed. The rate of seed, 3 lbs. the acre, compared with the formulæ rate, 7 lbs. per acre, is low, but the experimenter on the authority of the cultivator remarks that "this was too much and the crop would have been better had it not been so close." I request Mr. Gamble's attention to remarks on pages 8-9, Crop Experiment Report, 1884-85, regarding the necessity of taking 1 lb.=39 tolás. The details of the cost of cultivation are so well described and the whole experiment is so interesting that I print it in full (Appendix H).

Experiment No. 49, Gram.—The value of the present experiment on gram is derived chiefly from the excellent account given by Mr. Gamble of the husbandry of the cultivator of a holding of 3 acres 13 gunthás. He takes first crops of Navni or millet (the same as Rála) and black gram (37 G.) and bájri (26 G.). Of this the Navni was a success, the others failed. The black gram was followed by garlic irrigated from the well of a neighbour, who took half the crop and paid half the expenses. This was only a 12-anna crop. The bájri portion was left waste and the Navni succeeded by gram. The necessary weeding and manuring (about 10 cart-loads the acre) was done for the kharif. The subsequent operations on the gram (area 1 A. 30 G.) are thus detailed :—

"After the Navni had been cut the ground was harrowed (haragona) first with the 4-bullock harrow (*kunte*), then ploughed with the 2-bullock plough (*rante*) and then again harrowed with the *kunte*. It was then cross-ploughed with the "*rante*" and sown by means of the "*akkadi saddi*" or "*bukka*," a hollow bamboo attached at the bottom by a string to the *rante* and which follows in the furrow made by the "*rante*," being held in an upright position by the sower. After the sowing it was immediately harrowed with the *kunte* to cover up the seed, and finally the clods were broken and the earth smoothed by a flat log of wood drawn over to the ground by two bullocks, an

operation called in the vernacular "kord-hodiona." The ground was not bullock-hoed (yedi hodiona), nor was it weeded for the gram crop, though it was for the Navni.

The Khátedár and his two sons work in the field.

The harrowing, ploughing, &c., described was performed almost entirely by the Khátedár and his two sons. Two coolies, however, were employed for 3 half-days at the time of sowing as five men were engaged simultaneously in driving two ploughs, sowing and covering the seed by means of the *kunte*. Two sers of jowári were paid to each per half-day, which at 16 sers of jowári to the rupee = 12 annas.

Six coolies working for two days from day-break till 10 A.M. are employed to pull the crop. The gathering is not continued till later in the day as the seed-pods are said to drop from the stalks if the crop is pulled in the heat of the day. To each of the coolies thus employed 1 ser of gram is given per day, which at 8 sers to the rupee = Rs. 1-8. The threshing and winnowing of the seed, which takes 2 or 3 hours only, is done by the Khátedár and his family, no hired labour being necessary.

Thirteen *padis* or 26 sers of gram were sown in the field, which at 8 sers to the rupee = Rs. 3-4."

The hired labour for 1 A. 30 G. area cost as follows :—

	Rs.	a.	p.
Sowing—2 men for 3 days at 2 sers jowári = 2 annas per diem ...	0	12	0
Gathering—6 men for 2 days at one ser gram = 2 annas per diem...	1	8	0
Seed—26 sers gram at 8 sers per rupee	3	4	0
Total ...	5	8	0

= Rs. 3-2-3 per acre.

Mr. Gamble has not attempted to value the household labour on the other operations.

As an indication of the incidence of assessment, this experiment is of less value inasmuch as the gram is merely a secondary crop. It indicates, however, as mentioned by Mr. Gamble, that the rayat had an ample surplus even from this crop for payment of the revenue demand.

Mr. V. R. Purandhare, District Deputy Collector.

Mr. Purandhare has submitted an experiment (No. 50) which he terms special, but which, for want of attention to the plainest rules for the conduct of such an experiment, it is impossible to accept as such, *e. g.*, the experiment is in reference to a single field while the cultivator cultivates another field and lives for five months by working as day-labourer. The calculations of yield, even for the purposes of an ordinary experiment, are not correct. The field is one of wheat and safflower, so sown that the proportion of wheat to safflower is 8 to 1. The area actually cropped being 4 acres 39 gunthás — 4 acres 17 gunthás will be under wheat and 22 gunthás under safflower. The experimenter superintended the harvest of the whole field. The yield of wheat for the whole field was actually cropped. The following table shows the details :—

Crop.	Area.	Yield.		Value of Yield.		Total.	Value per Acre.
		Grain.	Chaff.	Grain.	Chaff.		
	A. g.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Wheat	4 17	2,771	4,700	79 2 9	23 8 0	102 10 9	23 3 3
Safflower	0 22	224	...	4 0 0	...	4 0 0	7 4 4
Total ...	...	...	...	...	...	106 10 9	...

Thus the total value of the yield of the whole field is Rs. 106-10-9, or, as in every one acre area under wheat and safflower mixed, there were $35\frac{9}{16}$ gunthás of wheat and $4\frac{7}{16}$ gunthás of safflower, the yield per acre, comes to,

	Gunthás		Rs. a. p.
Wheat	$35\frac{9}{16}$	... ... Value	20 10 0
Safflower	$4\frac{7}{16}$	... ... „	0 12 10
	40		21 6 10

The assessment per acre is Rs. 1-15-5. Therefore the incidence is 9·17 per cent. and not 8·46 as worked out by the experimenter.

The calculation of cost of cultivation shows inconsistencies which make it not worth quoting in detail. But it comes to a moderate amount, viz. Rs. 5 per acre, including the value of household labour. The cultivator certainly does well even according to the showing of the experimenter.

This field and another of which we have no detail keep him employed for only 7 months, in return for which this field yields him 106 rupees' worth of gross produce. The cost of cultivation, *including wages for his own work*, on the field and the keep of his bullocks and his rent amount to Rs. 60. He therefore has Rs. 46 surplus on which to feed his children and buy any other necessaries for himself during the year from this field alone. He is clearly for a man of his class at least solvent or worth some fair amount of credit.

Bija'pur.

From Bijápur Mr. Harvey sends one ordinary experiment (No. 51), the only remark required on which is that the yield is the result of a single picking only. This leaves some uncertainty as to the total yield. Mr. Harvey has explained that there was no probability of much more being obtained from the field.

Kola'ba.

No crop experiment was made in this district during the year under report. Mr. Jayakar, the District Deputy Collector, was, in addition to his own duties, in charge of Assistant Collector's office with extra jamábandi work as special officer. He also states that he commenced an experiment in November last in the Alíbág Táluka and was prevented from completing it by a sudden fall of rain.

Ratna'giri.

Mr. W. C. Rand, Assistant Collector,

Furnishes two carefully conducted experiments on Harik. The outturn seems to be correctly calculated, but, if so, illustrates most instructively the small amount of reliance that can be placed on local estimates of yield. On soils of apparently similar quality in one case an estimated 4-anna yield gives 594 lbs. per acre; in the other a 12-anna yield only gives 441 lbs.

Further, Mr. Rand's calculation of the cost of cultivation shows how exceedingly difficult it is to get at the truth in this question. In the first experiment an acre requires the time of one man for 64 days, in the second for 30 days. In the first the rate of bullock keep is Re. 0-1-4 per diem, in the second only 6 pies. The cost of cultivating an acre of harik in the first instance comes to Rs. 10 and in the second to Rs. 4 only. It seems impossible to reconcile the discrepancies. But it is at any rate worth noting that in the so-called 12-anna crop, taking the lower charge for cultivation, or Rs. 4 per acre, notwithstanding the moderate assessment, there is hardly sufficient margin to pay it, much less after allowing the rayat's wages for his work on the land at 2 annas per diem per adult man and for his bullocks' keep worth only 6 pies per diem. If this crop be not a full one the rayat would have some margin in a better year. Again for the first experiment if the rent be charged one-third of the produce or about Rs. 2-8, and the cost of cultivation be put at the lower figure of Rs. 4, the rayat scarcely has any margin. Again, the incidence of the assessment, though only nominal or in both cases when calculated on the land under occupation, rises to something very appreciable, when fallows are taken into account. Thus for the first experiment the land is fully cropped twice in eight years, in the second case three times in eight years, the true incidence therefore is in the first experiment nearly nine per cent. and in the second ten per cent.

82.6.5.

Again, comparing the survey assessment with the customary rent, viz. one-third of the produce, we find that taking fallows into account the rents amount to about $3\frac{3}{4}$ times the assessment.

Ka'nara.

From Kánara come two experiments on sugarcane with remarkable results.

Mr. Wiltshire's experiment (No 54) over 1 acre 5 gunthás field, very highly cultivated, gives a yield of 8,171 lbs. of *gul*, representing apparently something like a 14-anna crop and the local estimate of a bumper crop is declared to be 1,200 lbs. for 3 gunthás or 16,000 lbs. per acre!

Mr. Wiltshire has taken his ser at 24 tolás and this agrees with the ser of *gul* forwarded to this office. Therefore this startlingly high yield does not appear to be over-estimated. The yield is slightly higher than that recorded by Mr. Snow for poudrette-manured cane near Poona.

Mr. Lucas's experiment again shows a yield of 5,520 lbs. in sandy soil in Supa, only irrigated from a tank.

A somewhat similar experiment with only flood irrigation in 1885 gave an acre yield of 6,300 lbs., which Mr. Ozanne thought incredibly high, and Mr. Gleeson's in the same táluka, 5,880 lbs. I am inclined to think the yield on this occasion correctly estimated.

Both Mr. Wiltshire and Mr. Lucas have appended full estimates of the cost of cultivation. They reach the startling totals of Rs. 431 and Rs. 582 per acre inclusive of a valuation of household labour. Mr. Wiltshire's high estimate is intelligible, because he allows the phenomenal rate of wages of 5 annas 4 pies per man and the farming is very high. The actual wages may or may not be lower. At some periods of the year labour in Kánara is undoubtedly high. The cost of cultivation near Poona was estimated by Mr. Snow at over Rs. 360 and the operations were less elaborate than in this field near Supa.

I consider Mr. Wiltshire's calculations trustworthy, presuming his rates to be correct, and accordingly I append his memorandum in full.

Cost of cultivation of an entire field in Sirsi Táluka, of 1 acre 5 gunthás.

(Experiment No. 54.)

Date.	Operation.	Cost. Rs.	a.	p.
	Levelling the ground, 100 men for one day, at 5 annas 4 pies each per day	33	5	4
	Making cane beds, preliminary manuring and planting, 100 men for one day at ditto	33	5	4
	Preparing burnt earth and ashes, manuring cane with same, 50 men for one day at ditto ...	16	10	8
	Manuring cane third time, 120 men, ditto	40	0	0
	Weeding, twisting blades round stalks, 50 men ditto ...	16	10	8
	Watering cane for 3 months :—			
	First month, plants watered thrice a week, 180 men ditto ... ... Rs. 60			
	For remaining two months, twice a week, 240 ditto ... ... „ 80	140	0	0
	Watching canes : 1 man for six months at Rs. 2-8-0 per month	15	0	0
	40 cart-loads of manure at 3 annas per cart at Sirsi ...	7	8	0
	Carting above to field at 5 annas 4 pies per cart ...	13	5	4
	Tolls for 40 carts for 13 days at 4 annas a day ...	3	4	0
	Fencing field, 20 men for one day at 5 annas 4 pies each...	6	10	8
	Total ...	325	12	0
		×8		
		2,606	0	0
		÷9		
	Cost of cultivation per acre ...	289	8	11

Bill of Charges (cutting 4 gunthás cane and converting the same into molasses).
(Experiment No. 54 in Sirsi Táluka.)

Date.	Operation.	Cost. Rs.	a.	p.
1st March 1888 ...	Cutting and removing cane to mills, bringing fuel from jungle, miscellaneous work at mills and furnaces, 20 men for one day at 5 annas 4 pies each	6	10	8
1st and 2nd March 1888.	Man and buffaloes to work one mill and extract three iron sugar-pans of juice, at 5 annas 4 pies per pan ...	1	0	0
	Ditto ditto at second mill	1	0	0
2nd March 1888...	4 coolies working at first mill at 5 annas 4 pies each ...	1	5	4
	3 ditto ditto second mill ...	1	0	0
3rd March 1888 ...	1 man weighing molasses for half-day at 5 annas 4 pies per day	0	2	8
	Hire of two iron pans used (thrice each) to boil the juice, at 4 annas per pan on each occasion	1	8	0
	Rent of two mills to extract 6 sugar-pans of juice, at 4 annas per pan	1	8	0
		14	2	8
				×10
	Cutting one acre of cane and converting the same into molasses	141	10	8
	Add cost of cultivation per acre	289	8	11
	Total ...	431	3	7

Mr. Lucas's estimate of cost, on the other hand, I consider erroneous. He has obviously fallen into error in assigning Rs. 12 as a charge for watching 3 gunthás of land for six months. The same charge for 45 gunthás in Mr. Wiltshire's estimate is only Rs. 13-5-4. Mr. Lucas has made the mistake of calculating the cost of cultivation on the 3 gunthás only and thence deducing the cost per acre. This is not a good method. The calculation should be made by ascertaining and valuing the actual processes and labour employed over the *whole* area cultivated with the crop under experiment, and thence should be deduced the cost per acre.

There are other points also open to criticism. Mr. Lucas has taken much pains and it is hoped will try again.

There are mentioned one or two interesting practices in the culture of sugarcane, *e. g.*, the manuring and tying down of the cane, thus described by Mr. Wiltshire :—

"Manure consists of leaves, grass and cow-dung. Green leaves are used during the rains and dry leaves and grass during the summer. The land is manured with grass and leaf manure early in March before the sugarcane is planted and again 40 days after the plants are planted, when the plants are about 1½ feet high, with burnt earth and ashes of field sweepings, and again a third time 8 or 10 days before the monsoon, when the sugarcane is about 4 or 5 feet high, the plants are manured with grass and leaf manure. Two months after the rains in August the field is weeded out by manual labour. Soon after this the blades of cane are twisted round the stalks to prevent the destruction of the cane by jackals and wild cats. About 40 cart-loads (480 head-loads) of leaf and grass manure are needed to manure this field of 1 acre 5 gunthás and an equal amount of burnt earth and ashes are required."

Summary of the Crop Experiment

No.	District, Ta'luka, Village, and Experimenter.	Crop.	Local estimate in annas.	Average per Acre.					
				Seed.	Yield of		Total value of produce.	Assessment excluding Local Funds.	Percentage of assessment on the value of gross produce.
					Principal product.	By-product.			
1	2	3	4	5	6	7	8	9	10
	AHMADABAD.			Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	Mr. M. C. Gibb, Assistant Collector.								
1	Dáskroi (Hansol)	Bájri	12	8	629 grain.	466 bundles kadbi.	27 9 8	3 0 0	10·87
2	Paránti j (Paránti)	Rice (Sutarsál).	12	40	2,995 grain unhusked.	5,867 straw.	76 5 1	1 5 9	1·78
3	Paránti j (Butal, Modása Peta)	Irrigated wheat "Vájia."	12	160	1,201 grain.	960 straw. 610 chaff.	39 10 2	1 4 9	3·27
	Mr. M. P. Khareghát, Assistant Collector.								
4	Viramgám (Viramgám) ...	Do. ...	13	100	1,120 grain.	1,016 light chaff. 468 rough chaff.	43 4 0	1 1 4 assessment 2 0 0 water-rate. 3 1 4	2·50 7·12
	Mr. Edalji Dosábhái, District Deputy Collector.								
5	Dholka (Dholka)	Dry-crop wheat "Chásia Daudkháni."	...	71	728 grain.	576 chaff.	30 1 4	1 11 0	5·60
6	Dholka (Muphlipur)	Barley irrigated.	12	71	810 grain.	900 straw.	22 3 10	1 8 0	6·74
	KAIRA.								
	Mr. G. Carmichael, Assistant Collector.								
7	Mátar (Viroga)	Barley ...	12	81	636 grain.	267 straw.	12 4 8	3 5 11	27·41

Area of test.	Equivalent in tolás of measure ser.	Remarks.
11	12	13
A. g.		
0 6	40	*Experiment No. 1.*—Spiked millet, *bájri*, followed by wheat on a poor gorádu soil. Manured with 20 cart-loads of cowdung and straw in July. Rotation, (1) jowári, (2) bájri, followed by irrigated wheat, (3) bájri; and (4) (the present year) bájri to be followed by irrigated wheat. Cultivation good and season an average one, but the failure of late rains reduced the crop to 12 annas in local estimate, which, according to the formulæ for the táluka, is equal to 975 lbs. the acre. Grain yield compared with the formulæ yield low. By-product was not weighed. The incidence is calculated on the kharif crop only and hence high. The formulæ rate of seed per acre is 10 lbs. Prices, 31¼ lbs. of grain and 62 bundles of straw the rupee.
0 3	40	*Experiment No. 2.*—Soil originally classed as dry-crop gorádu, but a portion (33 gunthás) now cropped with rice and manured at 14½ cart-loads the acre, and irrigated from the Háthmati Canal. Rotation, (1) twice math, (2) math and grain, (3) bájri, kodra, math and vari, and (4) math and grain. Cultivation good and the insufficiency of the late rains was made up from the canals. The yield locally estimated at 12 annas, representing 1,500 lbs. the acre according to the táluka farmulæ, but the actual yield is 2,995 lbs. the acre. 30 lbs. of seed were sown on 1 guntha of seed bed, and the seedlings transplanted over the whole rice land area 33 gunthás, thus giving an acre rate of 37 lbs. while the formulæ rate of seed for the transplanted area is 15 lbs. the acre. Incidence in column 10 does not include water-rate Rs. 3 per acre, and the land yet classed as dry-crop. Figures appear doubtful as the sample ser received from the experimenter weighed on 29th November last only 32 tolás. Crop appears to be rather wet when weighed by the experimenter. Prices, 41 lbs. of grain and 15¾ cwts. of straw per rupee.
0 4	40	*Experiment No. 3.*—Irrigated wheat, Vájia, on a gorádu soil, growing every year bájri (kharif) and wheat (rabi). Manured with 25 cart-loads of cowdung and straw per acre in June before bájri was sown. Cultivation indifferent and season unfavourable. The crop was attacked by rust and reduced to 12 annas in local estimate. The actual grain yield compared with the formulæ yield (1,425 lbs. the acre) rather low and the seed rate compared with formulæ rate (130 lbs.) high. The incidence in column 10 is calculated on rabi crop only, and is remarkably moderate. Prices, 31 lbs. of grain and 10½ cwts. of straw per rupee.
0 10	40	*Experiment No. 4.*—Soil gorádu or light red growing both either kharif or rabi crops according to the season. More than one crop seldom taken. It is irrigated from a well for which a separate water-rate is levied. This year sown with bájri, which ran to straw owing to irregular rainfall and was therefore ploughed in. Manured with cowdung and town sweepings in October. Cultivation fair. Scanty late rains, crop estimated at 13 annas (= 1,625 lbs. the acre, formulæ) The rate of seed compared with the formulæ rate (130 lbs. the acre) low. Prices 27½ lbs. of grain and 6 cwts. of chaff per rupee.
0 10	40	*Experiment No. 5.*—Chásia Daudkháni (dry-crop) wheat on a *besar* or mixed soil, growing only one crop, wheat, every year. Unmanured. Cultivation good. Early rains favourable, but late rains scant, and cloudy weather in January-February with occasional showers injured the crop. The yield in local estimate not given, but the actual yield represents 10 annas (750 lbs. the acre) according to the formulæ for the táluka. The formulæ rate of seed per acre is 60 lbs. for the dry-crop wheat. Prices, 26¼ lbs. of grain and 2¼ cwts. of straw per rupee.
0 4	40	*Experiment No. 6.*—Soil gorádu growing juvár and barley. Irrigated from a neighbouring well, but not manured for 7 or 8 years. Cultivation good and season favourable. The yield locally estimated at 12 annas, representing 1,200 lbs. the acre (táluka formulæ). Seed rate low compared with the formulæ rate, which is 120 lbs. the acre. Prices 41 lbs. of grain and 3¼ cwts. of straw per rupee.
0 6	40	*Experiment No. 7.*—Soil gorádu or light, growing both bájri and barley crops, but this year kharif season fallow. Unmanured. Cultivation good and season favourable, but the crop was irrigated from a well, the brackishness of which marred the good effect of irrigation. Compared with the formulæ yield for the táluka (1,275 lbs. the acre), grain yield very low. The formulæ seed rate per acre is 120 lbs. By-product very low. Taking into account that this year was fallow and that only a small part of the field was cultivated the incidence is not heavy. In ordinary years it would probably not be less than half or even a third. Prices, 52¾ lbs. of grain and 11½ cwts. of straw per rupee.

Summary of the Crop Experiment

No.	District, Táluka, Village and Experimenter.	Crop.	Local Estimate in annas.	Average per Acre.					
				Seed.	Yield of		Total Value of Produce.	Assessment excluding Local Funds.	Percentage of Assessment on the value of gross Produce.
					Principal Product.	By-product.			
1	2	3	4	5	6	7	8	9	10
	KAIRA—*continued.*			Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	Mr. G. Carmichael, Assistant Collector—continued.								
8	Mátar (Jhikka)	Wheat, hard red "Kátha."	12	64	1,022 grain.	314 chaff.	33 3 8	3 1 10	9 37
	Mr. Motilál Chunilál, District Deputy Collector.								
9	Borsad (Borsad)	Spelt "Poptia."	...	92	851 grain.	696 straw.	28 0 0	5 10 0 salámi, 9 10 0 assessment by the Survey Department.	20·09 34·37
	PANCH MAHA'LS.								
	Mr. Motilál Chunilál, District Deputy Collector.								
10	Dohad (Nimnália)	Maize... ...	6	15	275 grain.	225 kadbi.	5 15 2	1 2 5	19·35
	Mr. Pránlál Harkisandás, District Deputy Collector.								
11	Dohad (Nimnália)	Soft red wheat "Kátha."	6	128	1,138 grain.	1,213 straw.	33 12 9	1 2 5	3·40
	BROACH.								
	Mr. Chunilál Venilál, District Deputy Collector.								
12	Broach (Bhád Bhut)	Wheat "Kátha" and "Pota" mixed.	14	51¼	1,162 grain.	2,188 chaff.	52 4 8	4 15 6	9·50
13	Do. (do.	Do. ...	6	41	451 grain.	656 chaff.	19 1 0	4 13 4	25 35
	Mr. H. O. Quin, Assistant Collector.								
14	A'mod (A'mod)...	Cold weather júvár unirrigated.	12	6	970 grain.	3,971 kadbi.	32 5 9	5 14 1	18·17
15	Do. (do.)	Láng (chickling vetch).	16	30	812 grain.	689 gotar.	15 6 8	5 3 0	33·64

Reports, Northern Division, 1887-88—continued.

Area of test.	Equivalent in tolás of measure Ser.	Remarks.
11	12	13
A. g.		
0 6	40	*Experiment No. 8.*—Middling black soil (dry-crop), growing continuous wheat. Manured before monsoon at 15 cart-loads of cowdung the acre. Cultivation good, but season fair. Crop estimated at 12 annas (900 lbs. the acre táluka formulæ) and better than similar crops in the neighbourhood. By-product compared with the grain yield extraordinarily low. Incidence evidently moderate. Prices, 31 lbs. of grain and 6¾ cwts. of straw per rupee.
0 10	40	*Experiment No. 9.*—Irrigated spelt, Poptia, grown on *besar* or mixed soil. Cultivation good and the late rains insufficient. Rotation bájri and juvár (kharif) followed by Poptia, spelt (rabi). Manured in June at 62 cart-loads of tank deposits before the sowing of bájri, and 6 local maunds of oil-cake the acre after bájri was taken off and before the spelt was sown. Formulæ rate of seed for irrigated wheat is 130 lbs. the acre. The crop was grown only on half the field and apparently followed a kharif crop, the value of which is unestimated. The incidence, therefore, of the assessment upon the outturn taken for the rabi from this field, quite twice as high as that shown here, while the incidence on the outturn of kharif and rabi together is unknown. Prices, 31 lbs. grain and 8¼ cwts. of straw per rupee.
8 10	40	*Experiment No. 10.*—Soil gorádu ash-coloured and unirrigated. Manured before first ploughing in June, with cowdung. Cultivation indifferent and season unfavourable, September rain being heavy. Crop in local estimate 6 annas representing 600 lbs. the acre according to the formulæ for the táluka. Rotation kharif maize followed by rabi wheat and gram. Rate of seed compared with the formulæ rate, 24 lbs. the acre, very low. The field grows both the kharif and rabi crops, but the incidence of assessment in column 10 on kharif only and hence high. Prices, 46 lbs. of grain per rupee, and of straw unknown.
0 10	40	*Experiment No. 11.*—Unmanured dry-crop wheat on the above land. Cultivation indifferent and season unfavourable. A 6-anna yield represents 675 lbs. the acre (formulæ). Figures untrustworthy as the sample ser forwarded to this office weighed only 26 tolás, which possibly indicates that the crop was very wet when weighed or weighing balance incorrect. Rate of seed according to the formulæ is 70 lbs. the acre, compared with which that entered in column 5 is very high, for dry-crop wheat. The incidence of assessment on the joint yield of the kharif and rabi in this field is only 2·90 per cent., which is unusually light. Prices, 34½ lbs. of grain per rupee and of straw unknown.
0 6	40	*Experiment No. 12.*—Unmanured dry-crop wheat, Kátha and Pota mixed, on 1st class black soil. Season favourable and tillage good. The crop estimated locally at 14 annas, representing 1,137 lbs. the acre according to the táluka formulæ. The formulæ rate of seed is 60 lbs. per acre. Prices, 30 lbs. of grain and 1¾ cwts. of chaff per rupee.
0 6	40	*Experiment No. 13.*—Unmanured dry-crop wheat on medium black soil growing cotton. Cultivation indifferent though season favourable. The high incidence appears due to indifferent tillage. 6-anna yield represents 487 lbs. the acre, formulæ yield for the táluka. Seed rate low compared with the formulæ rate of seed (60 lbs. the acre). Prices, 30 lbs. of grain and 1½ cwts. of chaff per rupee.
0 6	40	*Experiment No. 14.*—Black soil growing cotton and juvár. Unmanured. Cultivation good and season favourable, though sowing rain at first more than sufficient. Yield locally estimated at 12 annas, representing 1,050 lbs. the acre according to the formulæ for the táluka. Seed rate half of the formulæ seed rate (12 lbs.). By-product compared with grain yield very large. Prices, 35 lbs. of grain and 8 cwts. of straw per rupee.
0 6	40	*Experiment No. 15.*—Unmanured chickling vetch on a similar soil growing cotton. Cultivation good and season favourable, and the crop in local estimation 16 annas, which is equal to 900 lbs. the acre according to the formulæ. This season the land was fallowed with láng after last year's cotton. The formulæ rate of seed 40 lbs. the acre. Incidence high on the fallow crop. Prices, 73½ lbs. of grain and 1½ cwts. of gotar per rupee.

Summary of the Crop Experiment

No.	District, Ta'luka, Village and Experiments.	Crop.	Local Estimate in Annas.	Average per Acre.					
				Seed.	Yield of		Total Value of Produce.	Assessment, excluding Local Funds.	Percentage of Assessment on Value of gross Produce.
					Principal Product.	By-product.			
1	2	3	4	5	6	7	8	9	10
	SURAT.			Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	Mr. R. A. L. Moore, Assistant Collector.								
16	Jalálpur (At)	Sugarcane, Vánsi.	16	1,436 whole canes	7,666 gul.	2,533 bundles of dry canes = 28,000 lbs.; 533 bundles of green tops = 9,060 lbs.; 8,000 bundles of dry leaves = 4,240 lbs.	505 4 5	11 2 3 soil and water combined.	2·20
	Mr. B. Robertson, Assistant Collector.								
17	Chikhli (Bodvank)	Vál, "Kadva," Dolichos Lablab.	8	67½	315 grain.	1,280 gotar.	8 7 0	1 14 4	22·47
18	Do. (Ohand)	Do. ...	13	95	875 grain.	2,700 gotar.	26 11 6	10 0 0	37·43.
	Mr. Umedrám Ranchhoddás, District Deputy Collector.								
19	Olpád (Sándhiyer)	Monsoon juvár, "Bhár" juvár.	12	8½ juvár, 3½ tur.	677 grain.	1,564 kadbi.	26 1 9	6 6 5	24·51
20	Do. (Takárma)	Do. ...	12	6¾	741 grain.	1,680 kadbi.	27 7 7	5 15 9	21·78
	THÁNA.								
	Mr. R. M. Kennedy, Assistant Collector.								
21	Bhiwndi (Shelár)	Rice, "Garvel".	12	60	2,534 grain in husk.	80 lbs. chaff and 513 bundles of grass = over 9,920 lbs. straw.	58 8 8	4 15 9	8·52

Reports, Northern Division, 1887-88—continued.

Area of test.	Equivalent in tolás of measure Ser.	Remarks.
11	12	13
A. g.		
0 3	37½	*Experiment No. 16.*—Sugarcane, vánsi, on a black soil classed as garden and irrigated from a well. Rotation undefined, but during the last four years, rice and vál, with rice alone in the two following years, followed by sugarcane in the third. Manured at the first ploughing in November with 31 cart-loads of cowdung, and again in August, that is, 8 months after ploughing, with 51 local maunds of khol or castor-oil cake the acre. Cultivation good and season throughout favourable to the crop. The yield locally estimated at 16 annas = 7,000 lbs. the acre according to the formulæ. Formulæ rate of seed 20,000 sets per acre. Prices, 19 lbs. of gul, and 63 bundles = 6¼ cwts. of dry canes; 20 bundles = 3 cwts. of green tops and 200 bundles of dry leaves, per rupee.
0 6	37½	*Experiment No. 17.*—Kadva vál unmanured and unirrigated, following rice on káli or black soil mixed with kankar. Rotation undefined, but usually juvár is grown as a rabi crop. Vál has taken the place of juvár this year as the early rain was excessive to juvár. Cultivation indifferent to bad. The heavy rain in early November killed the tender plants and the stout ones only had survived. The crop was, therefore, estimated at 8 annas = 475 lbs. the acre according to the formulæ for the táluka. The seed in column 5, compared with the formulæ rate of seed per acre (40 lbs.), high. The by-product when weighed was green. Incidence in column 10 on the rabi crop only. Prices, 62 lbs. of grain and 3¼ cwts. of gotar per rupee.
0 4	37½	*Experiment No. 18.*—Irrigated vál following rice as in experiment No. 17 on a berad, a mixed black and gorad soil. Rotation, 3 years of rice and vál, followed by a fourth of sugarcane. This year the field was not manured for vál, but was manured for rice at 16 cart-loads the acre of cowdung. Cultivation good, but the crop sown rather late in November, was slightly damaged by the cloudy weather. The yield locally estimated at 13 annas, showing an acre yield of 772 lbs. according to the formulæ for the táluka. Seed-rate more than the double of the formulæ rate. Incidence on the second crop only. Prices, 52 lbs. of vál and 2½ cwts. of gotar per rupee.
0 9	37	*Experiment No. 19.*—Bhar or monsoon juvár, with tur in a rough proportion of 5 : 2 on fairly good black soil growing cotton in alternate years. Manured at 8 cart-loads the acre. Cultivation good, but the early heavy showers and scant October rains affected the growth of the crop, yet the November rain favourable, which improved the crop and the yield locally estimated at 12 annas (1,200 lbs. the acre according to the táluka formulæ), but the actual yield shown in column 6 very low. Tur was not ripe at the time of the experiment, and the incidence in column 10 on juvár alone. Prices, 34 lbs. of grain and 2¼ cwts. of kadbi per rupee.
0 9	37	*Experiment No. 20.*—Unmanured monsoon juvár on a first class black soil growing cotton in alternate years. Manured two years ago at 12 cart-loads the acre. Cultivation good. The early heavy rains greatly injured the crop when it was 20 days' old; but during the subsequent break the plants shot up again and the November rain generally improved the crop up to a yield locally estimated at 12 annas. The grain yield, as in above experiment, low. Prices, 35 lbs. of grain and 2½ cwts. of kadbi per rupee.
0 6	58	*Experiment No. 21.*—Late rice, garvel, annually on a black soil called tari. Manured with cowdung in the nursery and rabed. Cultivation fair and season favourable. The crop locally estimated at 12 annas representing according to the táluka formulæ 2,000 lbs. the acre, but the actual yield larger by one-fourth. Straw compared with grain high, due to wetness of the former when weighed by the experimenter. Figures given as reported, but a sample ser measure of the crop experimented on, received at this office, weighed only 45 tolás instead of 58 shown in column 12. Prices, 48 lbs. of grain in husk and 91 bundles, or 15¾ cwts. of straw per rupee.

Summary of the Crop Experiment

No.	District, Ta'luka, Village and Experimenter.	Crop.	Local Estimate in annas.	Average per Acre.					
				Seed.	Yield of		Total Value of Produce.	Assessment excluding Local Funds.	Percentage of Assessment on Value of gross Produce.
					Principal Product.	By-product.			
1	2	3	4	5	6	7	8	9	10
	KHA'NDESH.			Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	Mr. E. C. Morrieson, Assistant Collector.								
22	Nandurbár (Nandurbár) ...	Linseed ...	16	5½	370 seed.	...	13 2 4	1 0 2	7·68
	Mr. R. E. Kánga, Additional District Deputy Collector.								
23	Erandol (Erandol) ...	Kharif jowári.	14	4½	1,356 grain.	264 bundles = 7,972 lbs. kadbi, 362 lbs. bhusa, refuse, grain, &c., &c.	41 3 4	2 1 6	5·08
24	Do. (Kásoda)	Do. ...	10	4¾	730 grain.	292 bundles =3,392 lbs. kadbi, 276 lbs. refuse, grain and bhusa, &c., &c.	26 15 4	1 2 4	4·25
	Mr. H. R. Shirhatti, District Deputy Collector.								
25	Amalner (Vijkhed, Párola Petha).	Dry-crop wheat	12	41	1,002 grain.	1,240 chaff.	36 10 8	1 1 1	2·91
26	Do. (do.) ...	Gram... ...	12	42	1,272 grain.	720 bhusa.	35 13 4	1 11 8	4·82
	Mr. G. D. Pánse, Assistant Collector.								
27	Bhusával (Varangaon) ...	Bansi wheat...	14	35	808 grain.	1,186 chaff.	30 6 8	1 15 6	6·47
28	Do. (do.) ...	Do. ...	14	35	732 grain.	893 chaff.	27 4 8	1 15 7	7·23
29	Do. (Edalabad) ...	Gram... ...	14	56	662 grain.	813 bhusa.	19 5 2	1 14 11	10·00
30	Do. (do.) ...	Linseed ...	10	18	160 seed.	...	7 8 0	1 14 11	25·76

Area of test.	Equivalent in tolás of measure ser.	Remarks.
11	12	13
A. g.		
0 18	128½	*Experiment No. 22.*—Linseed on an inferior black soil, locally called *rái chikan*, unmanured. Cultivation good and season favourable. Rotation, (1) gram, (2) cotton, (3) linseed followed by wheat if rain favourable and bájri if rain irregular. The crop locally estimated as a good average crop. This at 12 annas should yield according to the formulæ some 400 lbs. per acre. Rate of seed lower than the formulæ rate per acre (12 lbs). The sample of local ser measure forwarded to this office weighed at 123 tolás, but the figures are here given as reported. Prices, 28 lbs. of seed per rupee.
0 10	137	*Experiment No. 23.*—Unirrigated kharif jowári locally known as Elichpuri or Mothi jowári on a medium black soil growing til, bájri, cotton and wheat. Soil, though unmanured this year for jowári, was manured for wheat two years ago at 34 cart-loads of cattle droppings and rubbish the acre. Cultivation good, but the heavy early November rain favoured the growth of fresh weeds in the field and reduced the yield to 14 annas = 1,170 lbs. the acre, according to the formulæ for the táluka. The sample of measure ser of grain forwarded to this office and weighed on the 15th February was found to be equal to 136 tolás. Prices, 42 lbs. of grain and 8¼ cwts. of kadbi and bhusa, &c., per rupee.
0 10	137	*Experiment No. 24.*—Unirrigated jowári on a similar soil with indifferent tillage. Rotation, jowári and cotton in alternate years. The land is manured at cotton sowing only at 3 cart-loads of cow-dung and rubbish the acre, and no second crop, as a rule, is grown on it. Heavy late rains this year prevented weeding of the field for the second time. Compared with the above experiment the yield low and locally estimated at 10 annas=810 lbs. the acre (formulæ), and the incidence is also low probably due to the low assessment, tillage being bad. The sample ser received from the experimenter at this office weighed on the 15th February 138 tolás. Prices, 42⅔ lbs. of grain, and 3⅓ cwts. of kadbi, &c., per rupee.
0 6	134	*Experiment No. 25.*—Medium black soil growing alternately wheat and cotton. Unmanured. Cultivation fair and the field found with patches of hariáli. Sowing rain, though heavy, favourable, and the crop estimated at 12 annas, which represented 800 lbs. the acre according to the formulæ for the táluka. Rate of seed compared with the formulæ rate per acre (32 lbs.) high. Figures given as reported, but the sample ser weighed 143 tolás on the 20th March last. Prices, 30 lbs. of grain and 3½ cwts. of chaff per rupee.
0 6	136½	*Experiment No. 26.*—Gram on a similarly conditioned soil. Rotation, bájri and gram in the same year followed by cotton in the next. The crop estimated at 12 annas = 560 lbs. the acre, formulæ. Actual yield greater than double of the formulæ yield. Seeding higher than the formulæ seed rate. Weight of sample ser on 20th March last, 139 tolás. This year gram followed bájri, but the incidence in column 10 on gram alone. Prices, 38 lbs. of grain and 2½ cwts. of bhusa per rupee.
0 6	139	*Experiment No. 27.*—Dry-crop wheat Bansi on a first class black soil. Rotation, jowári, cotton, wheat, linseed and gram. Slightly manured. Cultivation good and season favourable. The crop reported to be in excellent condition, but grain yield low compared with the formulæ, representing 900 lbs. the acre for a 14-anna yield. Prices, 28 lbs. of grain and 5½ cwts. chaff per rupee.
0 6	138	*Experiment No. 28*— Do. do. do. Prices, 28½ lbs. of grain and 5 cwts. of chaff per rupee.
0 12	146	*Experiment No. 29.*—First class black soil growing in rotation, wheat, linseed, tur and gram. Cultivation good, but the field not manured. Season favourable and crop estimated at 14 annas (630 lbs. according to the táluka formulæ). Seed-rate high compared with the formulæ-rate (30 lbs. the acre). Value of the by-product not included in column 10. Prices, 34½ lbs. of grain per rupee.
0 12	117	*Experiment No. 30.*—Unmanured linseed on a similar soil growing the same crops as in the above experiment, *e.g.* (1) wheat, (2) gram, (3) tur and (4) linseed. Cultivation fair, but the crop damaged by heavy showers in January and by *gerwa*. Principal product in column 6 for a 10-anna yield, the formulæ equivalent for it being 310 lbs. per acre, low. The seed-rate compared with the formulæ rate (12 lbs. the acre) high. Prices, 21⅓ lbs. of seed per rupee.

Summary of the Crop Experiment

No.	District, Ta'luka, Village and Experimenter.	Crop.	Local Estimate in annas.	Average per Acre.					
				Seed.	Yield of		Total value of Produce.	Assessment excluding Local Funds.	Percentage of Assessment on the Value of gross Produce.
					Principal Product.	By-product.			
1	2	3	4	5	6	7	8	9	10
	NA'SIK. *Mr. J. Davidson, Assistant Collector.*			Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
31	Málegaon (Sohegaon)... ...	Bájri, Sasguri.	12 to 14	6½	573 grain.	1,298 kadbi.	21 1 6	1 14 4	8·98
32	Do. (do.)	Do. 'Dhokli.'	10 to 12	7	723 grain.	1,350 kadbi.	25 7 6	1 11 11	6·85
	Mr. S. M. Fraser, Assistant Collector.								
33	Sinnar (Sinnar)	Rice 'Kamod.'	14	71 nearly for the transplanted area	1,860 grain in husk.	3,255 straw, 13 bhus.	58 12 10	1 11 3 assessment 9 5 0 water-rate	2·89
								11 1 0	18·81
34	Niphád (Niphád)	Gram 'Pivla' or yellow.	15	„ 43⅓	1,018 grain.	473 bhus, 200 stalks.	23 8 1	2 0 9	8·70
	Mr. Shridhar Gundo, District Deputy Collector.								
35	Dindori (Dindori)	Bájri	12	6 bajri, 2 tur, 1 kulith.	200 lbs. grain.	840 lbs. kadbi.	5 15 0	0 10 8	11·23
36	Do. (Pada)	Nágli	12	2	467½ grain.	635 straw.	8 3 8	0 5 4	4·05
37	Do. (A'mbegaon)	Wheat 'Pivla'.	12	48	605 grain.	350 chaff.	16 4 0	1 1 3	6·63
	AHMADNAGAR. *Mr. V. B. Vádekar, District Deputy Collector.*								
38	Karjat (Karjat)	Jowári 'Dagdi'.	6	7	208 grain.	216 bundles = 408 lbs. kadbi.	5 0 8	0 4 6	5·57
39	Shrigonda (Ghugal Vadgaon)...	Irrigated wheat 'Bakshi'.	12	31	1,087 grain.	1,560 chaff.	32 1 11	0 6 5	1·25

Reports, Central Division, 1887-88—continued.

Area of test.	Equivalent in tolás of measure Ser.	Remarks.
11	12	13
A. g.		
0 8	146	*Experiment No. 31.*—Unmanured and unirrigated bájri on a black soil manured with village sweepings about 3 years ago. Rotation undefined, viz., 3 years of bájri followed by one year of cotton. Cultivation good and the early rains promised a bumper yield, but the crop damaged by scant September rain. The yield locally estimated at 12 to 14 annas, *i.e.*, 640 to 720 lbs. the acre according to the formulæ for the táluka, but the actual yield very low. Compared with the formulæ rate of seed, 9 lbs. the acre, the seed-rate in column 5 low. Prices, 36 lbs. of grain and 2¼ cwts. of kadbi per rupee.
0 8	143⅓	*Experiment No. 32.*—Bájri alternating every 3rd or 4th year with cotton, on a similar soil. Manured. Incidence in column 10, compared with the experiment above, low, owing probably to manure, cultivation and season being the same in both cases. Bájri suffered this year in Násik district from excessive rain in latter part of the season and the average yield is estimated at 10 annas (=500 lbs. the acre, formulæ). Prices, 37 lbs. of grain and 2¼ cwts. of kadbi per rupee.
0 4	81⅓	*Experiment No. 33.*—Best black soil irrigated from a *pát* and growing in rotation, (1) ground-nut, (2) sugarcane and (3) rice and wheat (khapli). Manured after the first rain about the middle of June at 28 cart-loads the acre for seed-bed. Cultivation good and the green manure of tág or hemp was also applied in late August prior to transplantation of the seedlings. Season throughout and particularly late rains, favourable. This year two crops were grown on the land—rice and wheat—but the incidence calculated on rice alone and hence high. 14 annas formulæ yield in the táluka represents 2,025 lbs. the acre. Compared with the formulæ rate, rate of seed in column 5, high. Prices, 35½ lbs. of grain and 5 cwts. of straw per rupee.
0 6	116⅔	*Experiment No. 34.*—Best dry-crop black soil manured once in two years and growing in alternate years bájri and wheat or gram instead, if October rain scant. Cultivation excellent and season good. The yield in local estimate 15 annas, representing 620 lbs. the acre for the táluka. Rate of seed high, compared with the formulæ rate, 30 lbs. the acre. Actual yield in column 6 greater than the formulæ yield—a rare occurrence in Násik District. Prices, 45 lbs. of grain and 7½ cwts. bhus per rupee.
0 6	119	*Experiment No. 35.*—Unmanured bájri mixed with tur and kulith on a medium black soil, growing in rotation (1) bájri and tur, (2) wheat and kardai. This year tur was mixed with kulith. Cultivation indifferent and season favourable. Incidence in column 10 on bájri alone as the by-crops were not ready at the time of the experiment (*vide* Analysis above, page 14). Prices, 40 lbs. of grain and 8 cwts. of kadbi per rupee.
0 6	93⅓	*Experiment No. 36.*—Unmanured and unirrigated kharif nágli on a black rugged soil locally called *káli murmat mál.* Cultivation indifferent and early rain favourable, but late rain slightly injured the crop. Rotation undefined, but the field grows nágli, rice, udid, wheat, gram, sáva, kardai in different parts in the same year, each part cultivated after 2 or 3 years' fallow. The yield in local estimate 12 annas=1,200 lbs. the acre, formulæ. Formulæ seed-rate 9 lbs. the acre. Actuals in columns 5 and 6 very low. Prices, 63 lbs. of grain and 6½ cwts. of straw per rupee.
0 8	118	*Experiment No. 37.*—Unmanured wheat, dry-crop, on *madhyam káli* or medium black soil. Rotation (1) wheat for 2 or 3 years, (2) gram, (3) khurásni. Tillage fair, land only tolerably clean. Rain abundant, but November rain inopportune and excessive. Yield below that of the corresponding formulæ (720 lbs.); formulæ seed-rate 32 lbs. per acre. Prices, 38½ lbs. of grain and 5 cwts. of chaff per rupee.
0 10	107	*Experiment No. 38.*—Light or málrán soil growing every year dagdi—a variety of cold weather jowári. The field was neither manured nor ploughed. Sowing rain favourable, but the crop was afterwards injured by heavy late showers, which prevented weeding of the field. Yield low, due to indifferent tillage and probably to the soil, which is not the best possible for jowári. Prices, 55 lbs. of grain and 3 cwts. of kadbi per rupee.
0 6	12	*Experiment No. 39.*—Irrigated wheat Bakshi continually grown on a black soil. Unmanured this year. Manured last year after ploughing at 11 cart-loads the acre. Cultivation good and season though not favourable to jowári in the táluka was favourable to wheat, and the yield locally estimated at 12 annas, representing 1,080 lbs. the acre—táluka formulæ. By-product not included in column 8 as it is not used as fodder in the locality. Prices, 34 lbs. of grain per rupee.

Summary of the Crop Experiment

No.	District, Tá'luka, Village and Experimenter.	Crop.	Local Estimate in Annas.	Average per Acre.					
				Seed.	Yield of		Total Value of Produce.	Assessment, excluding Local Funds.	Percentage of Assessment on Value of gross Produce.
					Principal Product.	By-product.			
1	2	3	4	5	6	7	8	9	10
				Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	SHOLÁPUR.								
	Mr. N. B. Divatia, Assistant Collector.								
40	Málsiras (Málsiras)	Spelt 'Khapli' or 'Jod.'	8	124	1,325 grain.	376 chaff.	37 8 0	0 10 2	1·69
41	Do. (Dahigaon)	Do. ...	12	128	1,030 grain.	328 chaff.	30 0 0	1 2 0	3·75
	SÁTÁRA.								
	Mr. R. B. Stewart, Assistant Collector.								
42	Koregaon (Sonke)	Dry-crop wheat 'Bakshi.'	16	54	475 grain.	5⅝ nets or head-loads, weight not given.	19 1 9	0 10 4	3·38
	Mr. Rájdrám K. Vaidya, District Deputy Collector.								
43	Válva (Ashta)	Monsoon jowári 'Dukri.'	8	7½	436 grain.	210 bundles =505 lbs. kadbi.	11 7 10	2 0 0	17·40
	Mr. L. G. Deshmukh, Assistant Collector.								
44	Tásgaon (Nimni)	Jowári 'Dukri'	9	6	668 grain.	426 bundles =1,637 lbs. kadbi.	16 0 0	0 14 1	5·50
45	Do. (do.)	Rála	9	4	122 grain.	300 straw.	2 10 6	0 14 1	33·13
46	Khatáv (Nidhal)	Tur	9	10	333 grain.	1,280 bhus, &c.	8 0 0	1 5 5	16·73

Reports, Central Division, 1887-88—continued.

Area of test.	Equivalent in tolás of measure Ser.	Remarks.
11	12	13
A. g.		
0 6	102.	*Experiment No. 40.*—Irrigated spelt on a black soil classed as dry-crop, but irrigated from a well sunk by the rayat since the settlement and now growing maize, and bájri (kharif) and wheat, ground-nut, jowári, chillies (rabi) and sugarcane. Manured in May at 11 cart-loads the acre before being sown with maize as a kharif crop, and again at 6½ cart-loads the acre when the maize was removed and the field ploughed for rabi spelt. Cultivation good and the season, though unfavourable, had no effect on the crop being irrigated from a well. The crop locally estimated at 8 annas, but by the experimenter at 12 annas, representing 630 lbs. and 1,440 lbs., formulæ. The actual yield 1,325 lbs. the acre. The by-product compared with grain, small and omitted in column 8, being useless as fodder. Prices, 35½ lbs. of grain per rupee.
0 4	103	*Experiment No. 41.*—Soil brownish black locally called málset, growing both kharif and rabi crops. Manured at 14 cart-loads the acre before the monsoon. Bájri followed by spelt this year. Cultivation good and rainfall timely and favourable. The crop estimated at 12 annas, representing 1,440 lbs. the acre according to the formulæ. The rate of seed compared with the formulæ rate 64 lbs. the acre, high. Incidence in column 10 on the after-crop (spelt) only. Prices, 34½ lbs. of grain per rupee.
0 7	103	*Experiment No. 42.*—Soil *málrán* growing every year bájri kharif followed by rabi gram and occasionally by wheat. Lightly manured in May before bájri sowing. Cultivation good and season favourable to wheat. The yield in local estimation 16 annas, which represents 1,000 lbs. the acre according to the formulæ for the táluka, but the actual yield less than one-half of the formulæ yield. The discrepancy, probably accountable for by the soil which is not the kind on which wheat is usually grown, while the moderateness of the assessment shows the crop was full and remunerative. Seed-rate in column 5 compared with the formulæ rate per acre, 45 lbs., high. By-product not weighed. Prices, 26¾ lbs. of grain and 4 nets or head-loads of straw per rupee.
0 8	114½	*Experiment No. 43.*—Monsoon jowári locally called Dukri with tur in every 8th row. Area therefore divisible into 7 parts dukri and 1 part tur. Column 10 calculated on jowári alone. Soil was good black of considerable depth and manured in May after first ploughing and harrowing with cowdung ashes and house sweepings. Cultivation good, but crop damaged by early scant and late excessive rains. Yield by the village standard 8 annas = 490 lbs. the acre according to the formulæ. The figure in column 11 includes 7 gunthás of jowári and 1 of tur. Prices, 51 lbs. of grain and 1¼ cwts. of kadbi per rupee.
0 15	111	*Experiment No. 44.*—Jowári with tur in the proportion of 3 to 1. Tur was not ripe at the time of the experiment. The test was, therefore, confined to jowári alone as the sole crop of the year. The figure in column 11 represents the actual or net area under jowári in the 20-guntha plot experimented on. Soil middling black growing gram, dukri jowári and tur. Manured in April with cowdung and ashes. Cultivation good and season favourable both for tur and dukri. Prices, 57 lbs. of grain and 3¾ cwts. of kadbi per rupee.
0 4	95	*Experiment No. 45.*—Poor "Múrumád" soil growing in rotation bájri and rála. Unmanured, but cultivation good and season favourable, and the yield in local estimate 9 annas = 350 lbs. the acre according to the formulæ for the táluka. Area of test below the prescribed minimum. Prices, 48 lbs. of grain and 17¼ cwts. of straw per rupee.
0 10	116	*Experiment No. 46.*—This is an experiment for the purpose of estimating the yield of tur in experiment No. 44. The tur crop was taken in a similarly sown field with similar soil and apparent outturn. The yield is poor while the assessment in experiment No. 46 is considerably heavier than in experiment No. 44. Experiments Nos. 44, 45, and 46 are all in connection with the special experiment noticed on page 16 of the Analysis. Prices, 47½ lbs. of grain and 11½ cwts. of by-product per rupee.

No	District, Ta'luka, Village and Experimenter.	Crop.	Local Estimate in annas.	Average per Acre.					
				Seed.	Yield of		Total value of Produce.	Assessment excluding Local Funds.	Percentage of Assessment on value of gross Produce.
					Principal Product.	By-product.			
1	2	3	4	5	6	7	8	9	10
	BELGAUM.			Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	Mr. H. Woodward, Assistant Collector.								
47	Sampgaon (Murkibhávi) ...	Sugarcane ...	12	10,000 sets.	2,690 gul.	24,000 tops and leaves.	163 1 2	4 4 7	2·62
	DHÁRWÁR.								
	Mr. R. A. Gamble, Assistant Collector.								
48	Ránebennur (Benkankond) ...	Late or white Jowári, 'bile jola.'	12	3	631 grain.	1,566 kadbi.	16 2 0	1 14 0	11·62
49	Do. (Kakol) ...	Gram 'Kadli.'	10	54	466 grain.	...	11 15 0	2 1 8	17·63
	Mr. V. R. Purandhare, District Deputy Collector.								
50	Navalgund (Annigeri) ...	Wheat ...	9	27½ wheat, 3½ kardai.	608 grain.	1,062 chaff.	23 3 3	1 15 5	8·46
	BIJÁPUR.								
	Mr. W. S. Harvey, Assistant Collector.								
51	Hungund (Hungund) ...	Jowári cotton.	8	12	42⅔ clean cotton.	116 seed.	8 11 7	1 0 11	12·11
	RATNÁGIRI.								
	Mr. W. C. Rand, Assistant Collector.								
52	Dápoli (Padve)	Harik 'Dongya Pechadi mixed.'	4	32	594⅓	...	7 14 8	0 2 10	2·24
53	Do. (Durgvádi) ...	Do. 'Dongya.'	12	23	441¾	...	4 10 7	0 2 6	3·35
	KÁNARA.								
	Mr. Palmer Wiltshire, Assistant Collector.								
54	Sirsi (Hupanhalli) ...	Sugarcane 'Kempu rasdáli Khabbu.'	14	13,333 sets.	8,171 gul.	22,300 sets, 2,500 bundles of green tops, 2,480 lbs. dry blades.	545 5 10	2 8 11	0·46
	Mr. A. Lucas, Assistant Collector.								
55	Supa (Kávalvád) ...	Sugarcane 'Rasdáli Khabbu.'	10	11,333 sets.	5,520 gul.	9,200 lbs. seed joints, 21,000 top portions, 8,400 lbs. leaves, 16,800 lbs. crushed cane.	284 8 2 100 13 4 385 5 6	2 12 5 No charge for water.	0·72

Area of test.	Equivalent of measure Ser in tolás.	Remarks.
11	12	13
A. g.		
0 4	20	*Experiment No. 47.*—Sugarcane on a mixed black and red soil locally called *kára kemp misra Bhumi*, classed as 'pátasthal.' Rotation, sugarcane every third year followed by navni rági and similar light crops in the one and red pepper in the second year. Manured freely with cowdung ashes and goats' dung. Cultivation fair and rainfall abundant. The crop locally estimated at 12 annas, representing 4,800 lbs. of gul per acre according to the formulæ for the táluka, but the actual yield very low. Prices, 18¾ lbs. of gul and 10¾ cwts. of tops and leaves per rupee.
0 10	141	*Experiment No. 48.*—Unmanured late jowári locally called *bile jola* on a black soil merging at one end into red *masari* (brown). Manured for cotton in April last year at 10 cart-loads of cowdung and sweepings per acre. Rotation, early jowári alternating with cotton, but late jowári takes the place of early jowári in the year when early rain not timely. The crop locally estimated at 12 annas, but the yield compared with the formulæ yield (1,120 lbs.) very low, and the by-product compared with grain, high, being rather wet when weighed. Prices, 58 lbs. of grain and 2½ cwts. of kadbi per rupee.
0 10	142½	*Experiment No. 49.*—Gram after navni kharif on a brown *masari* soil. Manured in April for navni at 9 cart-loads of cowdung and house sweepings, the acre. Rotation, (1) early or monsoon jowári, (2) if early rain sufficient, sesame or navni, followed by white jowári or gram. Cultivation fair and the season favourable. The incidence in column 10 is calculated on a second crop only and hence high. By-product was not weighed. The sample ser weighed 144 tolás, Figures given as reported. Prices, 39 lbs. of grain per rupee.
4 39	149	*Experiment No. 50.*—Unmanured soil *yeri* or black. Rotation, (1) jowári, (2) cotton, and (3) wheat. Cultivation bad and sowing rain scanty, but late rains heavy and favourable. The sample ser of wheat forwarded to this office weighed only 143 tolás. This year wheat was mixed with safflower in the proportion of 8 to 1, but proportionate area under each was not noted. Report figures, therefore, incorrect, though given here as amended (*vide* Analysis above, pages 20-21). Prices, 35 lbs. of grain and 1¾ cwts. of chaff per rupee.
0 8	...	*Experiment No. 51.*—Late cotton alternating with jowári on *yeri holla* or black soil. Cultivation good, but season indifferent. Unmanured; number of pickings not given. The yield locally estimated at 8 annas, but the actual yield very low, compared with the corresponding formulæ yield at 140 lbs. the acre. Prices, 6 lbs. of clean cotton and 72 lbs. of seed per rupee.
0 6	61	*Experiment No. 52.*—Harik on hill-side or varkas soil growing alternately vari and harik. Cultivation fair but the field weedy, and early and later rains sufficient. The yield locally estimated at 4 annas, that is 80 lbs. the acre (formulæ), while the actual yield is 594 lbs. the acre. The rate of seed for harik in Dápoli is 9 lbs. the acre according to the formulæ for the táluka, but the reported rate per acre is 32 lbs. Prices, 75 lbs. of grain per rupee.
0 8	46¼	*Experiment No. 53.*—Upland soil growing náchni, harik and til. Cultivation good, but the crop damaged by scant October rain. The yield in local estimate 12 annas, *i.e.* 640 lbs. the acre according to táluka formulæ, yet the actual yield is 441 lbs. the acre. Rate of seed in this and the above experiment is very high. Prices, 94¾ lbs. of grain per rupee.
0 4	24	*Experiment No. 54.*—Sugarcane locally called kempu rusdáli khabbu, on a reddish marshy soil *Kumbar Kojje Mannu*. Manured (1) early in March with dry grass, cowdung and leaf manure before the cane is planted, at the rate of 36 cart-loads, (2) with an equal quantity of burnt earth and ashes of field-sweepings when the cane is 1½ feet high, *viz.*, after 40 days from the date of planting, and (3) 8 or 10 days before the monsoon when the cane is 4 to 5 feet high, with grass and leaf manure. Cultivation good and season fair. Yield very high compared with the formulæ yield,—5,400 lbs. the acre. The value of by-product, partially included in column 8, and green tops not weighed. Prices, 16½ lbs. of gul, 497 sets and 2½ cwts. of tops, &c., per rupee.
0 3	20	*Experiment No. 55.*—Sugarcane on *masári* or light sandy soil, usually sown with rice and irrigated from a tank. Manured in January-February with cowdung manure at 40 cart-loads the acre and not with leaf and grass manure. Cultivation fair but season rather unfavourable, and the crop estimated at 10 annas, representing 3,720 lbs. the acre according to the formulæ for the táluka. The actual yield compared with the formulæ yield of gul, very high. The formulæ rate of seed is 1,500 canes per acre for all tálukás in the district. Prices, 19½ lbs. of gul and 109 lbs. of seed-joints, 7½ cwts. sogi, 22½ cwts. of Sippi per rupee.

APPENDIX A.

Special Experiment (Remarks and Directions)

The special experiment was subjected to considerable criticism in the correspondence ending with Government Resolution No. 4461 of the 15 July 1887, the result of which was that Government expressed their opinion that in calculating the incidence of assessment on net produce, the item of the value of the household labour expended by the rayat on his holding should be omitted. Effect has been given to this ruling in the directions which accompany the form proposed for calculation of the cost of cultivation. For this purpose also the necessary alterations have been proposed in the standing orders.

But although the consideration of the rayat's subsistence is not to be mixed up with calculations of the incidence, it is proposed that its consideration should not be altogether excluded from the enquiry in the course of a special experiment.

The objects of a special experiment are at present to determine what are the profits of cultivation in, at any rate, the season of experiment. For this purpose it is necessary to determine whether the land yielded enough to remunerate the rayat for the labour he bestowed upon it, and for this determination must be ascertained the time he bestowed on the land and the fair remuneration for that time. By following out the directions for ascertaining the value of household labour and materials in the form proposed for calculating the cost of cultivation, the time bestowed and a fair cash value for it will be approximately ascertained. The cash value of the net outturn after payment of the necessary expenditure on external labour will be also determined. By comparison of these two items, viz. net outturn and value of household labour, the extent to which the holding was fairly profitable or the reverse to the rayat will be ascertained within tolerable limits.

With this purpose the following alterations are proposed in the standing orders and it is hoped will meet with the approval of Government :—

1. Paragraph (1) *for* "average produce" *substitute* "produce during the season of experiment."

2. In introduction paragraph 2 *omit* "what.....as to." After 'comfort' *add* : "(4) To ascertain how far the produce of the holding contributed towards the subsistence of the cultivator and his family, and if it did suffice only for a part of the year's subsistence, how the cultivator supported himself for the remainder."

Instructions.

3. *A—Ordinary Experiments.*—Paragraph (4), after "memorandum" *add* "tabulated in the annexed form, principal and most frequent operations, and points for inquiry are indicated in a list on the reverse of the form."

Omit "In order to.....explained."

4. *B—Special Experiments.—Omit* paragraph (4).

Paragraph (10), *omit* "From the gross to.....directed" and *substitute* "the net outturn should now be calculated for the entire holding as recommended in the cost of cultivation form for single crops. The net outturn ascertained in method (*a*) of the form will represent the amount left to the cultivator for his subsistence and the payment of assessment. The relation of this sum to the assessment on the holding should be determined."

5. "The net outturn ascertained in method (*b*) will show the surplus or deficit remaining after allowing a fair value for the total labour and materials bestowed upon cultivation of the holding. It is not necessary to show the relation of this item to the assessment."

6. "If a deficit result, the manner in which it is made up by the cultivator should be ascertained, if by labour elsewhere, the kind of labour, &c., or if by borrowing—then how his credit is maintained."

7. "If surplus over year's requirements, inquire how spent."

APPENDIX B.

Note regarding the Cost of Cultivation.

There are two objects in calculating the cost of cultivation—the first is to get at the amount actually left to the cultivator of the land after paying the necessary expenses. For this purpose we need only reckon the labour which the cultivator had to hire. This will vary with, among other things, the number of able-bodied persons in the cultivator's family. The more there are the less the hired labour. But of course while with a large family there is less to pay for hired labour, there will be more mouths to feed upon the net outturn. But in this manner we shall ascertain how much has been extracted from the land for the support of the cultivator and his household. The other objects to get at are the value of the total labour and husbandry invested in the land, and thus to see what sort of return the crop under experiment has yielded for the expenditure upon it in labour and materials during the season in question. For this purpose the value of the household labour and materials must be computed and added to the actual payments for external labour and materials.

2. To calculate the external labour the actual amounts given—whether by contract or daily wages—must be ascertained.

3. The method of calculating household labour is more difficult. It is necessary to ascertain the operations in which the cultivator and his household have been engaged, and then to fix the rates of wages due for such labour accurately and fairly.

In calculating this rate care should be taken not to charge fancy prices, *e.g.*, in an agricultural district the hire of men and bullocks for ploughing may be very expensive during the season, because the bulk of them may be employed in household labour. The fair rate to charge for the household labour is not that which would be given by a man compelled to hire in an expensive market, but the wages of a permanent farm servant employed on such work and the subsistence and charge for depreciation and replacement on bullocks and implements.

4. On this principle are conducted valuations of acts of husbandry in England, which have borne the tests of inquiry and examination by skilled experts, not only for purposes of scientific inquiry but in courts of law for determining damages and compensations. In India the rate of wages of a permanent farm labourer comes pretty near ordinary daily cooly-rates, the permanence of the employment making up for the otherwise lowness of the wage. This rate may be taken as a guide in districts where farm servants are uncommon, it is difficult to assign a money value to their wages, paid in kind or perquisites. It also follows that the wages for household labour, unlike hired or temporarily engaged labour, will not vary for the different operations. Thus in harvesting especially high wages, for watching low wages, would be given to a temporarily hired labourer. But the permanent farm servant would (perquisites apart) get a continuous rate of wages, or by reckoning perquisites on his yearly emoluments an average day value can be ascertained.

5. Again, for cattle the method of calculation is as follows—The feed for the year is computed and divided by the number of working days, which gives the charge for subsistence. The value of the beast at current market rates at a mature age for work is taken as the basis. One-tenth, say, is deducted for depreciation every year. This divided by the number of working days gives the daily charge for replacement. Keep *plus* replacement charges gives the total charge for the bullock.

6. In England implements are charged for with the working farm animals. But in this presidency replacement of implements is so small a charge that it is best to reckon it separately in a lump for all the implements, while their repair is charged for in the customary dues to the village artisans.

7. The rates fixed on these principles at Bhadgaon Farm are 3 annas per man and $2\frac{1}{2}$ annas per bullock per diem, and are, it is believed, usually sufficient. It is suggested that experimenters should take these rates as a standard wherewith to check the information given to them. I append a rough estimate of the kind for the charge for a bullock.

Estimate of Charge per Plough-bullock.

Replacement.

		Rs.	a.	p.
Original value Rs. 30, lasts seven years ... Per annum...		4	4	6

Keep.

7 months—15 lbs. kadbi per diem=say 500 lbs. per month at Re. 1 per 100 lbs.	35	0	0
5 months grass in cultivator's land or waste during monsoon at Rs. 2 per month	10	0	0
Oil-cake on 150 days at 3 pies per diem	2	5	6
Total per annum ...	51	10	0

310 working days per annum=2 annas 7½ pies or rather more than 2½ annas per diem.

8. In the above manner the labour values can be calculated for household as well as external labour. A word may be added about the ascertainment of the various operations and processes and their cost. It has been noticed that some experimenters estimate straight off the cost per acre or even the cost for the small area of 3 to 6 gunthás on which they have conducted their test.

9. A far preferable mode of proceeding is as follows:—

First ascertain all the operations performed on the whole field under experiment for the whole year. If the crop or crops under experiment are the sole ones in the field, all that has to be done is to ascertain the cost of the operations as indicated above and reduce it to the cost per acre. If, however, the crop under experiment occupies only a portion of the field cultivated by the rayat, endeavour should be made to ascertain what processes were peculiar to that particular part of the field. Thus a bit of land (10 acres) contains jowári (9 acres) and sugarcane (1 acre)—the sugarcane is experimented on. The whole field was ploughed in 30 days—in the absence of special information 3 days would be debited to the cane. On the other hand, the cane alone perhaps was fenced, irrigation beds made in it and watered. The whole field perhaps was manured, but the cane received an extra dressing.

10. By reference to the directions and approved records of the cost of cultivation embodied in the printed compilation of former crop experiments it will be possible to ascertain with certainty that all processes have been mentioned by the cultivator. It is necessary to be very particular in ascertaining the time occupied in every process, as this is one of the principal elements in determining the total amount and hence the value of labour bestowed on the crop. For this purpose it will be necessary to examine the cultivator patiently. A great assistance will be to obtain information from him regarding the different months, or failing them the "Nakshatras" on which he performed the operations, and if there appear gaps of time unemployed in the crop or field, to inquire what he and his cattle were about.

11. The results of these inquiries should be first written in narrative form and then summarised in the tabular form which will show—

(*a*) The total cost of the cultivation of the crop;

(*b*) The value of household labour and payments for external labour being shown separately;

(*c*) The total number of days on which the cultivator or members of his family and his cattle were employed;

(*d*) The number of days work required per man and pair of bullocks to rear and harvest the crop.

Form (proposed on page 2 above).

Operation.		Materials.		Human Labour.					Animal Labour.			Total cost for crop under experiment.	Cost per acre.	Remarks.
Serial No.	Description.	Description and amount.	Cost.	Men.	Women.	Children.	Days.	Cost.	Pairs of bullocks	Days.	Cost.			
			Rs. a. p.					Rs. a. p.			Rs. a. p.	Rs. a. p.		
1	Ploughing H	..	..	1	..	..	2	0 6 0	1	2	0 10 0	1 0 0	..	
2	Weeding E	..	..	..	10	..	3	3 12 0	..	..	..	3 12 0	..	
3	Manuring H	Cowdung, 100 cart-loads.	50 0 0	..	..	..	..	..	..	..	..	50 0 0	..	
4	Carrying Manure H ..	..	..	2	..	..	2	0 12 0	2	1	0 10 0	1 6 0	..	
5	Spreading do. H .. &c. &c.	..	..	2	..	..	4	1 8 0	..	..	..	1 8 0	..	
	Total ..	..	50 0 0	..	..	..	..	6 6 0	..	..	1 4 0	57 10 0	..	

H.—Household labour or materials. E.—External or purchased.

Kind of labour.	Serial No. of Operation.	Rates.					Remarks.
		Men	Women.	Children.	Pair of Bullocks.	Materials.	
		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
Household ..	1, 3, 4, 5.	0 3 0	0 1 6	0 1 0	0 5 0	8 annas per cart-load.	
External ..	2	..	0 2 0	..	..	..	The usual rate for monsoon weeding.

Abstract of Labour.			
	Household.	External.	Total.
Total men for one day.	14	20	34
Total bullocks for one day.	4	..	4
Total value, labour and materials	53 14 0	3 12 0	57 10 0

Directions for filling in the above form.

(1) The form suits both ordinary and special experiments.

(2) The rates for household labour should be calculated, as explained in the note, usually at the cash value of the wage of a permanent farm labourer. This will probably not vary much from the daily wage of ordinary unskilled labour. The rates for cattle should be taken at the cash value of their subsistence added to the charge for replacement (*vide* page 39).

The Bhadgaon rates, 3 annas per man, and 5 annas per pair of bullocks, may be taken as a standard for comparison, reasons for excessive variation from this standard being given.

(3) The net outturn should be shown as the gross outturn, less—

(*a*) Cost of external labour and materials, } *plus* Local Funds.
(*b*) Cost of total labour and materials, }

In the former case it will show the amount left towards the subsistence of the rayat and his household.

In the latter the surplus or deficit resulting after the land has paid the full value of the labour and materials expended on it during the particular season.

4. The result (*b*) is of most use for special experiments. Only (*a*) should be made use of for calculating the incidence of assessment on the net outturn, (*vide* Government Resolution No. 4461 of 15th July 1887) whether in an ordinary or a special experiment.

5. In the abstract of labour, women and children to be taken as fractions of a man.

List of Operations likely to occur in Cultivation of Ordinary Crops.

1. Draining.
2. Well-sinking.
3. Embanking and damming.
4. Levelling.
5. Making irrigation channels.
6. Clearing away stones or jungles.
7. Exterminating weeds—special measures for.
8. Ploughing.
   Digging or hoeing.
9. Fencing—value of thorns, timber or stone and carrying.
   Walling—putting up.
10. Manuring preliminary.
    (*a*) Value or cost of manure.
    (*b*) Carting to field.
    (*c*) Spreading.
    (*d*) Folding by sheep.
    (*e*) Artificial (castor-cake &c).
11. Ráb.
12. Making beds in garden lands, &c.
13. Harrowing.
14. Sowing—(*a*) Seed—its cost or value.
    (*b*) Drilling or broad-casting.
    (*c*) Planting seedlings.
    (*d*) Transplanting.
15. Harrowing in seed or otherwise covering.
16. Mud-ploughing (rice).
17. Weeding—(*a*) by bullock-hoe,
    (*b*) by hand.
18. Laying up or ridging.
19. Watering—(*a*) Canal charges or other special water-rates.
    (*b*) Well.
    (*c*) Basket-throwing.
20. Top-dressing of manure (*vide* heads under preliminary manure).
21. Miscellaneous work for harvest, *e. g.*, tying down cane, &c.
22. Watching.
23. Reaping or pulling or picking (with cotton, state number of pickings).
24. Binding.
25. Carrying.
26. Thrashing, milling, &c.
27. Winnowing, making gul, &c.
28. Storing—(*a*) Carrying.
    (*b*) Pitting.
    (*c*) Stacking.
29. Further processes before crop marketed.
30. Carriage to market. Crop how to be disposed of, to local sávkárs or by selling in bazár, by rail, or consumed.

APPENDIX C.

Note on the yield of various crops and the formulæ.

The great object of ordinary experiments is to determine in a number of different cases varying in locality, soil, season and cultivation, the yield of different crops, more especially of the different food staples and crops of commercial importance. It is thus possible to deduce approximately the average yield of certain crops as produced in the various *districts* under existing practice. As information is accumulated it will be possible to differentiate further and estimate averages for the different tálukás or even smaller areas corresponding to the different survey groups.

Estimates of average production in various tálukás already exist in the formulæ which were compiled under the orders of Government and based on actual experiment, and the knowledge of officers specially conversant with the subject and long accustomed to make experiments. But there has been some apprehension that these formulæ are wrong and especially that their estimates are too liberal. Our estimates of outturn are largely based on these formulæ. It is therefore most necessary to know how far they can be relied on, in what direction they require to be tested and the extent to which they need correction.

The crop experiments conducted and systematically recorded for five years already give valuable information on these points.

First, how are we to judge of the accuracy of the formulæ? These formulæ are estimates of average production. Actual production will, therefore, vary considerably from the formulæ with individual differences of soil.

Season and cultivation.—Some further margin also must be allowed for error in the local estimate of the crop in annas, which depends both on the judgment and veracity of the cultivator of the land under experiment and other persons belonging to the locality whom the experimenter is able to consult. Remembering these considerations in judging of the variation between actuals and formulæ, it will be clear that a real test of the accuracy of formulæ will be the degree of correspondence between the averages of a considerable number of yields determined by experiment and yields estimated by the formulæ.

To take an example, the following table shows the details of experiments in Broach District on wheat:—

Number.	Local Estimate in Annas.	Yield per Acre.		Remarks.
		According to Formulæ.	By Experiment.	
		Lbs.	Lbs.	
1	14	1,137	1,033	This gives average yield in seven different cases by the formulæ 740 lbs. per acre, by experiment 700 lbs.
2	13	1,056	953	
3	4	325	293	
4	9	731	733	
5	4	300	277	
6	14	1,137	1,162	
7	6	487	451	

It is difficult, on looking at a result of this kind, to avoid the conclusion that though actuals in some cases differ in particular cases considerably, yet on an average the formulæ give a fairly correct result.

I append another table showing the results worked out in this way for all crops on which five or more experiments have been carried out. Five experi-

ments are not sufficient to draw safe conclusions from, but I go as low as five for purposes of illustration :—

Crop.	District.	Number of Experiments.	Yield.		Difference per cent.		Remarks.
			According to Formulæ.	By Experiment.	+	−	
			Lbs.	Lbs.			
Jowári	Khándesh ...	6	1,060	760	...	28	Only experiments in which local estimate in annas is stated are taken into account.
	Sholápur ...	7	350	320	...	9	
Bájri	Násik	5	588	687	17	...	
Rice	Thána	7	1,550	2,951	90	...	
	Ratnágiri ...	18	1,857	1,661	...	11	
	Dhárwár... ...	6	1,129	1,559	38	...	
Wheat	Ahmadabad ...	8	1,587	1,002	...	35	
	Kaira	7	903	933	3	...	
	Broach	7	390	700	...	5	
	Khándesh ...	10	930	707	...	24	
	Násik.	13	736	578	...	21	
	Ahmadnagar ...	6	599	807	35	...	
	Poona	5	871	896	3	...	
	Dhárwár ...	5	464	540	16	...	
Maize	Panch Mahál ...	9	977	1,035	6	...	
Linseed	Khándesh ...	6	239	308	29	...	

These results are most instructive and call for few remarks.

In wheat, on which crop there have been the largest number of experiments, the correspondence between the actuals and formulæ is very striking. I believe that but for some flaw in the Násik wheat experiments the result would be even closer. In that district the lowness of the yields compared with the formulæ was noticed in 1884 and special investigations were ordered ; and taking the experiments since that time the correspondence has been very close, viz. in six experiments conducted in the years 1885-86 and 1886-87 the average yield for the formulæ was 740 lbs. and for the experiment 767.

Rice comes next to wheat with 31 experiments, but with less closely approximating results. The reason is no doubt on account of the confusion made in the reckoning of yields in the form of husked or unhusked rice.

The formulæ yields of wheat come far too high in Ahmadabad, Khándesh and Násik and those of jowári in Khándesh are apparently much too high. Those of wheat in Ahmadnagar and of maize in the Panch Mahál are decidedly too low. Regarding rice it is impossible to draw conclusions.

In only 5 out of 16 cases, or even eliminating rice, we may say in 4 out of 13 are the actual yields less than the formulæ. We may further deduce the conclusion that 900 lbs. of wheat is a good average anywhere, and where there is little irrigation 600. Perhaps I might say 1,600 lbs. of rice in level well-flooded rice land. There are not enough data to draw further conclusions, but these indicate that steady and sure progress is being made towards a knowledge of the average yield of crops over large areas. It is perhaps hardly too much to presume that the formulæ estimates as a whole are not above the mark, and that only a systematic extension of similar investigation is needed in order to gain similar knowledge over more circumscribed areas.

An examination of the crop experiment ledger shows also that experimenters should now turn more attention to the following crops :—

(1) *Bájri* everywhere except the Konkan.

(2) *Jowári* also wants much more attention; less perhaps in Gujarát than in the Deccan and Karnátak.

Other crops requiring study are—

(3) *Náchni and Harik* and kindred grains in the hills and Konkan.

(4) *Kardai* in the Deccan and Karnátak.

(5) *Til* in Khándesh.

(6) *Gram.*

(7) *Tur* everywhere.

(8) *Cotton* everywhere except the Konkan.

The early kharíf crops are much neglected. The rains make it difficult for such experiments to be conducted, but it should be quite possible to conduct a few, at any rate near head-quarter stations and places accessible by rail.

If these could be marshalled together in every one of the crops above mentioned a number of experiments equal even to those collected up to the present regarding wheat, a satisfactory test of the formulæ for the most important crops would be obtained and our general knowledge regarding the yield of crops largely extended.

APPENDIX D.

Note of important Standing Orders most frequently neglected.

I.—Statement of the rates at which prices are calculated, both for principal and by-product. Specification of date and market at which said rates are obtainable (*vide* remarks on columns 21 and 22, Director's Annual Report, 1883-84, page 34, and Crop Experiment Report, 1884-85, page 51, and Government Resolution No. 849, dated 7th February 1888, Revenue Department).

II.—In special experiments the submission to experiment of all crops in the holding or estimation on specified grounds of yield of those crops on which no test could be taken, and in the case of parts of the holding lying fallow or waste the area of such parts, reason for their non-cultivation, and profits from grazing (if any), or other use to which they may have been put, care and accuracy in calculation of outturn from mixed and row crops (*vide* Résumé of standing orders B—Special Experiment, paras. 8 and 9, Crop Experiment Report, 1884-85, page 52, para. 13).

III.—Amount of by-product, especially where useful as fodder, to be expressed in bundles (or other local measure) as well as in pounds (Remarks on column 20, Crop Experiment Report, 1884-85, page 51, para. 7).

IV.—Allowing product to dry, especially the principal product, before weighing. With the by-product the loss of weight by dryage in a sample bundle should be noted. (Crop Experiment Report, 1884-85, pages 8 and 9.)

V.—Weight of pound to be taken as 39 and not 40 tolás.

VI.—The selection of the crop or holding (*vide* Appendices A and C above for further instructions on this point).

APPENDIX E.

Extracts from ordinary Crop Experiment Report by Mr. S. M. Fraser, C.S., Násik.

Experiment No. 33—Irrigated rice; area, 1 acre 7 gunthás.

Manuring.

I, Seed-bed.—4 large cart-loads of cowdung were applied on the 5 gunthás set aside for seed-bed, viz., at the rate of 3½ cart-loads for a seed-bed of a field of one acre. Manure was spread after the first rain about middle of June.

II., Area planted out.—In June after first rain, *tág* hemp, had been sown and ploughed as green manure at end of August.

Sowing.

I., The seed-bed.—The manure having been applied after the fall of first showers; the seed was sown on the manure and both mixed with the soil by applying the *vakhár* or harrow, after the first rain. The bed is divided by raised lines *váphe*, but not in squares, to hold the water as in the rest of the field. Hand-weeding is required four times. If the rain is fair, *pát* water is not necessary for the bed.

II., The rest of the field.—The hemp (*tág*) sown in June was cut down in August when about a man's height, chopped into bits, buried, ploughed and soaked with *pát* water for 8 days until it became incorporated with the soil. On this the seedlings were planted out. The land had been ploughed two or three times before the hemp was sown and five times after it was cut straight and across. After the ploughing the *vakhár* was applied five times, the ploughing and harrowing both being done in the mud. Four bullocks are used to the plough and the *vakhár*. The field is then divided into little beds (*váphe*) to hold the water, and the seedlings planted in bunches of two or three after their roots have been separated by washing in the *pát*. For two days after planting out no *pát* water is given, to allow the plants to take root; rain water would not hurt. Water is then daily let into the beds, and when the seedlings are green again and plainly growing they should stand always in water except when they are pressed down by hand round the roots to strengthen them, after which the water is shut off for a day or two. Hand-weeding is required three or four times.

The owner gets water all the year round, his turn being 2 *ghatkás* = 48 minutes, every fourth day; and if the rain is good there is no difficulty. The turn is measured by the creeping of the shadow from any object over a marked space. The outturn depends entirely on the amount of labour put into the soil.

Cost of cultivation.

(1) Cost of manure (per acre)—

	Rs.	a.	p.
(*a*) Seed-bed, 3½ cart-loads at Re. 1 per cart	3	8	0
(*b*) 8½ páylis of hemp seed at 2½ páylis per rupee... ...	3	6	5
Total ...	6	14	5

N.B.—Cowdung manure had been applied before the crop of sugarcane cut in March. This is mentioned to show what had been the previous preparation of the field.

(2) The following hired labour had to be paid for :—

	Rs.	a.	p.
(*a*) *Preparing the beds, Váphe*, 20 men paid	5	0	0
(*b*) 4 weedings done by 4 hired hands assisted by house labour, Rs. 3 for each time	12	0	0
(*c*) *Reapings*, 8 hired hands paid with 1 páyli each, cost at 3 annas and 9 pies per páyli	1	14	0

Ploughing and threshing are done with his own *bails* and by his own family, which consists of 5 brothers and their wives and small children.

(3) *Baluta* or customary dues.

The Mhárs are not paid in Sinnar owing to an old dispute. The cultivator cannot say exactly what he gives to others, Lohár, Sutár, &c., but calculates that 3 *mans* (48 páylis) go out of the whole pôt number—value, Rs. 11-4-0.

	Rs.	a.	p.
Total of (2) and (3)	30	2	0
Proportionate expense to one acre	25	10	2
Cost of manure	6	14	5
Total ...	32	8	7

Very high and expensive cultivation is undoubtedly necessary to produce a good crop, but much confidence is not reposed in the accuracy of the figures here given for cost of cultivation.

The percentage incidence, 18·81 of the assessment, on the value of the produce seems heavy considering the excellence of the crop, but it must be remembered that rice is only one crop *produced in the year and is followed by wheat.*

— — —

Experiment No. 34 (Mr. Fraser's ordinary experiment in Niphád, Násik District, referred to in page 14, on gram.)

Cost of Cultivation.

Manuring.—Manure, viz., cowdung mixed with household ashes (mostly from cowdung cakes) which had rotted in the previous monsoon, was applied on May 20. Four *bail* carts, of which 5 or 6 had been bought at 8 annas per cart, were put into 2 acres, that area of the whole field being manured yearly in turn. One of the plots of experiment was out of the two acres manured, but no difference in the crop was apparent.

I., *Cost of manure.*—As stated above, of the 20 cart-loads applied to the 2 acres, only 5 or 6 were bought. Therefore 6 carts at 8 annas each = Rs. 3.

II. The land was ploughed 3 times with cross ploughings with one plough of 4 *bails.*

III. Harrowings 7 times in all. A short and heavy *vakhár* was used at the time of ploughing, once with 4 bullocks and four times with 2 bullocks. In September a longer and a lighter *vakhár* is used with 2 bullocks, once before sowing and once after. The heavy *vakhár* used first is stood upon, and as it goes 8 inches deep, roots up the weeds. The light one they do not stand upon and its use is to smooth the ground.

IV., *Weeding.*—There is no need to weed gram, as owing to the shortness of its stem it does not afford shade like wheat and other tall crops for the growth of weeds.

V., *Reaping.*—Each labourer gets $\frac{1}{16}$th part of what he collects.

VI. All the threshing and work in the *khala* is done by the family of the cultivator.

VII. The custom in Niphád is for a man to reward the Balutedárs according to the number of his *bails.* This cultivator has four and pays the Sutár 12 páylis, the Lohár 8, Chámbhár 12, Nhávi 12 (the Nhávi also gets bread from time to time), Parit 8, Kumbhár 8, Bhat 4, Mulána 2, and Guru 2. The Mhárs take 3 *sers* per acre, that is, 15 *páylis* on a holding of 20 acres. Total Baluta 83 *páylis* = 5 *mans* 3 *páylis.* This is on his whole holding of 19 acres 38 gunthás; that is Rs. 1-1-0 per acre at the price given.

∴ Total Rs. 4-1-0.

APPENDIX F.

Cost of Cultivation on a good land in Sátára, Area 6 A. 14½ G.

(Mr. Rájárám Khanderáv's ordinary experiment No. 43.)

Operation.	Men.	Women.	Bullocks.	Days.	Total Cost in Grain.	Total Cost in Cash.	Remarks.
Household Labour.						Rs. a. p.	
Harrowing twice in *Chaitra.*	1	...	2	4	.....	...	These operations were performed by the cultivator and his family and consequently no actual money was spent on them.
Manuring, making small heaps in *Vaisháh.*	1	...	...	3	.....	...	
Harrowing twice in *Vaisháh* to spread manure.	1	...	2	1	.....	...	
Harrowing once in *Ashádh* after sowing.	1	...	2	2	.....	...	
Hoeing once in *Shrávan* when crop was 6 inches high.	1	...	2	2	.....	...	
Watching from 15th of *Kártik* to 15th of *Paushya,* 30 days.	1	...	...	30	.....	...	
Paid Labour.							
Manure	...	...	...	...	.....	3 4 0	
Ploughing once in *Chaitra* .	2	...	8	16	.....	6 0 0	Out of these 8 bullocks 4 were employed on hire.
Sowing with Kuri in *Ashádh.*	2	...	2	2	6 sers jowári.	0 5 6	Bullocks obtained on loan, and therefore nothing was paid for them.
Hand weeding in *Bhádrapad.*	22	...	...	2	64 „ „	3 10 6	
Reaping	10	...	...	1	40 „ „	2 4 7	
Separating ears from stalks.	...	10	...	1	20 „ „	1 2 4	
Thrashing and winnowing...	3	...	...	2	12 „ „	0 10 11	One of these was cultivator himself and the others were paid.
Binding bundles of kadbi ...	8	...	...	1	24 „ „	1 5 11	
Customary dues	...	...	...	...	124 „ „	7 1 4	
Total ...	...	...	...	...	290 sers ...	25 13 1	

Total number of days for one man, of which the cultivator worked on 42 days only ... 151
Total number of bullocks employed for one day 150
Total Cost, Rs. 25-13-1, out of which Rs. 16-9-1 in grain and Rs. 9-4-0 in cash.

Gross produce per acre ... ... Rs. 11 7 10
Actual cost per acre ... ... „ 4 1 0

APPENDIX G.

Ordinary Experiment in Belgaum by Mr. H. Woodward, referred to on page 19.
Crop: Sugarcane.

Plot 1.

The field was on low-lying ground adjacent to a *nála* from which it was irrigated. The portion taken for experiment was at the north-east corner on the side farthest from the *nála*. The soil was black with a tinge of red in it, and was of inferior quality. The crop was healthy and in good condition. This part of the field being farther from the *nála*, the canes were less vigorous and close-packed than I found them in *Plot* 2, the reason being, I suppose, that the soil bordering on the water contained more moisture.

Plot 2.

The plot selected was 2 gunthás at the south-west corner of the field as above remarked, the canes were somewhat stronger and thicker than in *Plot 1*.

Remarks.

The land sown with sugarcane was 24 gunthás in extent. There was no trace of disease nor any other form of injury to the crop. The canes were healthy enough, but seemed stunted in size. The farmer was satisfied with the outturn and said it was neither worse nor better than the average in the same land. The crop was representative, neither superior nor inferior to many others that I saw in the neighbourhood growing under precisely similar conditions of soil and water. The entire number was 3 acres 20 gunthás assessed at Rs. 15.

	A.	g.
Bágáyat	2	25
Jiráyat	0	35
Total ...	3	20

Sugarcane is grown in patches in these parts of usually not more than ½ acre in extent. I was unable to find a larger area on which to experiment. Sugarcane is grown on the same land every third year. The first intervening season being devoted to "nayni," "rági" or some other light crop and the next to red-pepper. Sugarcane is the most exhausting of crops. The soil was freely manured with cow-dung ashes and goats' dung. The farmer declares that he purchased Rs. 16 worth of cow-dung and paid in grain Rs. 5 to the owner for the use of his flock. This figure is no doubt exaggerated and I have made some abatement in it. The rainfall was so abundant this year that by putting a dam of earth and stone across the *nála* the water rose of itself and flowed into the irrigation channel. Little expense was incurred under this head. In ordinary years the water has to be raised by baskets from the bed of the *nála* into the channel. This channel supplies various other crops of other cultivators and the sugarcane under experiment was watered only once a fortnight. The soil gave evidence of moderate attention and industry, but the clearing of weeds had not been assiduous. On the whole, I should consider the farming fair, but not high-class. The field was about ¼ mile from the village, which is a very small one and purely agricultural.

The cost of production is calculated as under:—

1. *Ploughing.*

	Rs.	a.	p.
3 pairs of bullocks with one man for each pair for two days, at the rate of 3 annas a day for each man and 3 annas a day for each pair of bullocks	2	4	0

N.B.—The plough used is the large Deccan "Nángar" of considerable penetration and great weight. Three pairs of strong oxen at least are required to draw it and their progress is very slow. They have to go over the ground not once, but several times.

2. *Sowing.*

	Rs.	a.	p
(*a*) Cost of seed—6,000 seedlings at Rs. 2 per 1,000 ...12	0	0	
(*b*) Labour—4 labourers for 2 days at 3 annas a day each ... 1	8	0	

N.B.—The market value of the seedlings is given. The number planted is said by the farmer to have been nearer 7,000 than 6,000.

3. *Raking and Weeding.*

4 labourers for 4 days at preceding rates 3	0	0	

4. *Fencing in the crop.*

	Rs.	a.	p.			
(*a*) 4 men for one day at 3 annas	0	12	0			
(*b*) Cost of thorns	1	0	0			
				1	12	0

5. *Watching.*

One man for 2 months at Rs. 2 a month 4	0	0	

N.B.—This man was also employed to keep an eye on the other crops, but the sugarcane was his chief care. I have debited that product with half his wage only.

6. *Watering.*

Repairing the embankment and channel from time to time ... 1	8	0	

N.B.—No other expense was incurred under this head. The outlay was divided among several holders of land, who take the water in turns as arranged among themselves.

7. *Cutting and carrying canes to the mill.*

5 men for 3 days at 3 annas a day each 2	13	0	

8. *Manure.*

(*a*) Rs. 10 cost of cow-dung and of spreading it... ... } 15	0	0	
(*b*) Folding sheep and goats on the plot for 4 days Rs. 5 ... }			

9. *Working the mill.*

3 men for 3 days at 3 annas each a day 1	11	0	

10. *Manufacturing the juice into raw sugar.*

3 men at 6 annas each for 3 days 3	6	0	

N.B.—Specially high wages are given for this part of the operation because the work is trying and requires skill and careful attention.

11. *Fuel for boiling*	5	0	0	

N.B.—Dried cotton and tur stalks and the dried leaves of the date-palm are used in great quantities. A quick and steady blaze is essential. Fuel of all kinds is peculiarly dear in these parts.

12. *Bullocks.*

During the manufacture six pairs for 3 days at 3 annas a pair each day 3	6	0	

N.B.—3 annas a day for the keep of a pair of bullocks is a fair estimate. They are fed on "*kadbi*," on the succulent tops and leaves of the sugarcane and occasionally on cotton seed, oilcake and chaff (*sarki, pend* and *bhusa*).

13. *Village haks*	3	0	0	

N.B.—The local deity, the Joshi, the barber, the Mhárs, the carpenter, the Dhobi and others, have all to be satisfied in kind out of the produce of the crop.

14. *Hire and wear and tear of implements and utensils* ...	2	8	0	
Total cost of production ...62	12	0		

The weight and value of the produce of the 4 gunthás experimented on must now be calculated. It will then be a simple matter to discover the outturn of the entire area of 24 gunthás. The weight of the *gul* derived from the two experiments combined was 262½ lbs. The market price of this quality at

the time of the first instalment and now is Rs. 1-8 per maund* (27½ lbs.), but this would not fetch more than the lower rate. Thus the value of the yield of the 4 gunthás experimented on is Rs. 14-4-11. Multiplying this by 6, we get Rs. 85-13-6 as the yield in money of the 24 gunthás sown with sugarcane. To this should be added Rs. 12 on account of the leaves and tops. Though not usually sold for fodder they are eagerly eaten by the cattle while the crop is being harvested. They are not apparently sold for seedlings. The farmer said that there was no immediate local demand for seedlings, and that those cut must be planted at once if they are to thrive. The arrangement usually made by growers of sugarcane is to bespeak the number of seedlings they require from a certain field and to prepare their own land for the reception of the plants as they are lopped off when the sugarcane is cut down.

*The finest quality is sold at Rs. 1-10 the maund.

	Rs.	a.	p.
The total value of the crop on the 24 gunthás of land is therefore	97	13	6
Deduct cost of production	62	12	0
Net Profit ...	35	1	6

Every detail of both experiments was carried out under my and the Mámlatdár's personal supervision. As the experiment from beginning to end extended over a period of nearly 24 hours (the manufacture goes on best in the cool of the night) we had to watch, turn and turn about. I think the estimate of net profits given may be relied on as approximately correct, though I do not under-rate the almost insuperable difficulties of obtaining precise details.

The following table gives an abstract of the cost of cultivation :—

Date.	Operation.	Men per day.	Pair of Bullocks per day.	Rate of Wages per diem. Men.	Rate of Wages per diem. Pair of Bullocks.	Total Number of Days.	Total Number of Men.	Total Number of Pair of Bullocks.	Total Cost.
1	2	3	4	5	6	7	8	9	10
				Rs. a. p.	Rs. a. p.				Rs. a. p.
	Ploughing	3	3	0 3 0	0 3 0	2	6	6	2 4 0
	Seed 6,000 sets, Rs. 2 per 1,000	...	...	...	...	...	...	...	12 0 0
	Planting	4	...	0 3 0	...	2	8	...	1 8 0
	Raking and weeding... ...	4	...	0 3 0	...	4	16	...	3 0 0
	Fencing the crop	4	...	0 3 0	...	1	4	...	0 12 0
	Cost of thorns	...	...	...	...	...	...	...	1 0 0
	Watching by contract ...	1	...	...	....	60	60	...	4 0 0
	Repairing embankments and channels	...	....	...	...	...	...	...	1 8 0
	Cutting and carrying canes to the mill	5	...	0 3 0	...	3	15	...	2 13 0
	Manure-spreading and cost of cow-dung	...	...	...	...	...	...	...	10 0 0
	Sheep-folding for 4 days ...	...	...	...	...	...	...	...	5 0 0
	Working mill	3	6	0 3 0	...	3	9	18	5 1 0
	Manufacturing juice into sugar	3	...	0 6 0	...	3	9	...	3 6 0
	Fuel for boiling	...	...	...	...	...	...	...	5 0 0
	Village haks	...	...	...	...	...	...	...	3 0 0
	Hire, wear and tear of implements and utensils... ...	...	...	...	...	...	...	...	2 8 0
	Total ...	...	...	...	...	78	127	24	62 12 0

	Rs.	a.	p.
Thus the cost of 24 gunthás area under sugarcane is ...	62	12	0
The cost per acre	104	9	4
And the yield per acre	163	1	2
The net profit	58	7	10

Thus the incidence of assessment, Rs. 4-4-7 per acre, on the value of net produce is 7·33 per cent.

APPENDIX H.

Ordinary Experiment on Jowári by Mr. R. A. Gamble referred to on page 19.

The total area of the field selected for experiment was 3 acres 29 gunthás. Of this 3 acres 23 gunthás were sown with white jowári, the crop experimented on, and 6 gunthás were sown with wheat. The field was black soil merging at one end into red soil. The black soil portion of the field measured 3 acres 3½ gunthás and the red soil portion 15½ gunthás. The wheat was sown at one end of the black soil portion. There was a small patch, measuring about 5 gunthás or rather more, in the red soil portion of the field, the crop of which was very bad. The three patches, however, were so selected as to give in the aggregate a very fair idea of the average crop of the field. The Khátedár holds five other fields assessed at Rs. 122, and measuring 60 acres 26 gunthás in the aggregate. He keeps four servants in his pay permanently, who work both in the fields and house. To two of these men he pays Rs. 24 and to the other two Rs. 16 a year, besides clothing and feeding.

The field is manured in alternate years, unless the manure consist of cow-dung only, when it is manured once in 3 or 4 years only. The field was manured immediately after the '*Ugádi* holiday' in the month of Chaitra, *i.e.*, about April 1886. 14 *chhakadis* and 15 *hallhandis* of cow-dung and house-refuse were applied. This was not purchased, but obtained from the Khátedár's own house. This year the field was not manured. The whole field was dug and turned in the month of April this year for the purpose of destroying the 'Karki' weed. This operation, called in the vernacular *natt kadiona*, is a very expensive one, and cost in the present instance no less than Rs. 80 for the whole field. An agreement, as is usually the case, was made with the labourers that they should dig again the ground if any the following year on which the 'Karki' should make its appearance, and Rs. 10 out of the Rs. 80 was kept back as a guarantee for this. It would appear that if the *natt kadiona* is properly done there is no necessity to repeat it for a great number of years.

No hand-weeding (*kale tegiona*) was done this year as it was unnecessary after the *natt kadiona*. Rain fell in June and immediately afterwards the field was ploughed with the *rante* with 2 bullocks. It was then harrowed (*haragona*) in cross lines with the *kunti* with 4 bullocks. The ground was then prepared for sowing with the *bála gunti*, a light harrow similar to the *kunti*, but smaller and drawn by 2 bullocks only. In the month of Ashvin (October) the seed was sown with a 3-coulter drill and covered with earth by means of the *bála gunti*. Three sers of seed were sown; but the Khátedár informed me that this was too much and that the crop would have turned out better had it not been sown so close.

To estimate the cost of cultivation in this case is a matter of considerable difficulty, it being practically impossible to determine with any accuracy what proportion of the pay of the permanent servants and of the Rs. 80 for the *natt kadiona* should be borne by the crop experimented on.

Disregarding the wages of the servants, we get the actual amount expended this year on the portion of the field under jowári to be:

	Rs.	a.	p.
For digging and turning 3 acres 23 gunthás, at Rs. 80 for 3 acres 29 gunthás	76	12	6
3 coolies to pull the crop for 3 days at 2 sers jowári a day ..	1	2	0
10 women to cut the jowári heads from the stalks after pulling for one day at 2 sers jowári a day ...	1	4	0
3 sers jowári seed	0	3	0
Total	79	5	6

The harrowing, threshing and winnowing was done entirely by the permanent servants.

Disregarding the wages of permanent servants, the Khátedár has this year expended Rs. 79-5-6 on the field.

We may perhaps get a fair estimate of the proportion of the servants' pay which should be borne by the crop under experiment by finding what would

have been the expenditure had coolies been employed in the harrowing, ploughing, &c. :—

	Rs.	a.	p.
Plonghing : 4 coolies for 2 days, at 2 annas a day ...	1	0	0
Harrowing with the *kunti* : 2 coolies, at 2 annas a day, for one day	0	4	0
For sowing and preparation of ground by *bâla gunti*, &c. : 4 men for one day and 2 men for one day, at 2 annas a day...	0	12	0
For threshing and winnowing : 6 coolies for one day, at 2 sers jowâri a day	0	12	0
Total ...	2	12	0

If, then, we take Rs. 2-12-0 as the proportion of the servants' wages and Rs. 8 as the proportion of the Rs. 80 for digging the field to be borne by the crop experimented on, we get as the cost of cultivation :—

	Rs.	a.	p.
For digging and turning	8	0	0
Wages of servants	2	12	0
3 coolies to pull crop for 3 days, at 2 sers jowâri a day ...	1	2	0
10 women to cut jowâri heads for one day, at 2 sers jowâri a day...	1	4	0
3 sers jowâri seed	0	3	0
Total ...	13	5	0

To turn to the credit side of the account.

The outturn of 10 gunthás being Rs. 4-0-6, the outturn of the whole 3 acres 23 gunthás becomes Rs. 57-10-4 or Rs. 16-2-0 per acre. This year, therefore, the Khátedár, after his actual expenses on the crop and the payment of assessment and Local Fund cess, is Rs. 28-11-2 to the bad. The expenditure on the digging and turning of the land, however, must be considered in the light of an investment which will pay very high interest, as the effect of the *natt kadiona* operation has been to transform a bad field into one that may in future under ordinary circumstances be expected to yield a good crop.

Taking the proportions of the expenses on servants and on the digging and turning shown above, the Khátedár will have, after paying assessment and Local Fund cess, a balance of Rs. 37-5-4 to the good.

The Rs. 8 estimate for the proportion of the outlay on digging and turning to be borne by the crop experimented on is necessarily somewhat arbitrary, but I can see no data by which the exact amount can be determined.

I have estimated the pay of the women at 2 sers a day. They are, as a matter of fact, generally paid by an armful of jowâri heads, which amounts to about 2 sers. For this they work all day, whereas the coolie man gives half a day's work only.

Throughout my calculations I have taken 1 lb. = 40 tolás.

The crop in question was a good one, and rather above those in neighbouring fields, this being due to a great extent to the digging and turning of the soil, which, as said above, by the destruction of the 'Karki' weed had the effect of changing a poor field into a good one.

The crop of wheat in the 6 gunthás was slightly inferior to the jowâri crop. The weight of the outturn of grain per acre is somewhat small owing to the fact that in the Ránebennur Táluka the late jowâri yields considerably less grain per acre than the early jowâri.

The fodder of this jowâri is particularly liked by cattle and fetches a higher price than that of the early jowâri fodder. The weight of the fodder shown in column 20 is somewhat misleading, as it was, when weighed, in a wet state, and a considerable reduction from the weight must be made to allow for dryage.

Late jowâri is not grown to a very great extent in the Ránebennur Táluka and is generally, as in the present instance, grown when the rain falls unseasonably for early jowâri.